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Some Results of Physical Training Under the Army Specialized Training Program

By

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(Submitted for publication, February, 1945)

THE Army Specialized Training Program was inaugurated to prepare qualified soldiers for special tasks required by the Army. The established training facilities at regular army installations were inadequate in extent or kind for the training contemplated. Agreements were therefore entered into with civilian institutions to provide the training required. After receiving Basic Military Training and sometimes other Army training, adequately prepared trainees were selected and assigned to colleges and universities throughout the country for specialized training in engineering, medicine, dentistry, veterinary medicine, chemistry, personnel psychology, and foreign languages. The courses of study were prescribed by the Commanding General, Army Service Forces. Instruction, housing, and messing were, in general, provided by the participating institutions under the terms of their contracts with the government. The first contingents of trainees began this training in April of 1943.

Later there was also developed the Army Specialized Training *Reserve* Program designed to give college training to young men before their call to active duty. Those eligible for this program are members of the Enlisted Reserve Corps (Enlisted Reserve Corps, unassigned, and Air Corps Enlisted Reserve) and therefore have passed the Army's physical examination for general service. Being under draft age tnese students are on inactive status and without Army pay but the direct cost of their education is borne by the government.

In 1943 the Army Specialized Training Division was primarily concerned with the specialized training of soldiers on active duty, designated then as ASTP trainees and currently as *ASTAP trainees.* In the spring of 1944 there was a significant expansion of the Reserve Program in which 17-year-old youths, designated as *ASTRP*

students, are given training prior to induction into the Army. Thus there are provided two rather distinct groups. Separate studies have been made of the results of physical training in each. The purpose of this paper is to report the findings of these two studies.

It should be borne in mind that ASTAP trainees are soldiers who have completed their Basic Military Training. They are of varying ages with widely differing backgrounds; they have all had high school educations; many have attended and some have completed college; a few hold graduate degrees; all have made a score of 115 or better in the Army General Classification Test.

ASTRP students (including Enlisted Reserve Corps, unassigned, and Air Corps Enlisted Reserve) represent a far more homogeneous group. Not only are they younger than the ASTAP trainees but they are all of approximately the same age, namely, between 17 years and 17 years 9 months on the first day of the month in which training begins. With rare exceptions they are high school graduates but very few have had previous college training; they have all volunteered for the program; and all have made a score on the Army-Navy College Qualifying Test or the Aviation Cadet Qualifying Examination roughly equivalent to a score of 100 or better on the Army General Classification Test.

In the training schedules of both ASTAP trainees (with certain exceptions noted later) and ASTRP students, six hours a week, usually consisting of three two-hour periods, are devoted to physical training. When the time consumed in going to and from exercise areas, in bathing, dressing, etc., is subtracted, there remain about four and one-half hours each week for actual physical training activities. In addition to this prescribed physical training, participation in intramural athletics during free time is encouraged.

The two groups follow substantially the same program in physical training. The first four weeks are devoted to testing, screening, classifying, conditioning, and general orientation. During this period the men are observed and studied and then classified with respect to their individual aptitudes and deficiencies. For the remainder of the first 12-week term they are assigned to activities in which their deficiencies are greatest or in which further development is most desired.

The program at a participating institution is conducted by the civilian staff in physical education under the general supervision of the commandant. Activities stressed are aquatics, gymnastics, mili-

tary track, combatives, and team sports. After the initial four weeks, the usual lesson plan for normal individuals is about as follows:

15 minutes—change clothes and report
15 minutes—warming-up and conditioning exercises
30 minutes—gymnastics *or* military track *or* combatives
40 minutes—team sports *or* aquatics
20 minutes—bathe, dress, and report for next assignment.

All participants are tested shortly after admission to the program and at the close of each 12-week term of instruction. It is prescribed that men wear the standard gymnasium costume with basketball-type shoes while being tested. The earlier classes had some difficulty, however, in procuring this clothing and in some instances it was necessary for the men to wear the regular army uniform or some makeshift of it.

The prescribed physical efficiency test consists of a battery of seven events as follows:

Push-ups — To measure strength and endurance of arm and shoulder extensor muscles.
Squat-jumps — To measure strength and endurance of leg muscles.
Sit-ups — To measure strength and endurance of abdominal muscles.
Pull-ups — To measure strength and endurance of arm and shoulder flexor muscles.
100-yard pick-a-back — To measure general muscular endurance.
Squat-thrust (20 seconds) — To measure agility and coordination.
300-yard shuttle run — To measure cardiovascular-respiratory endurance and speed.

Point scores were assigned for different levels of performance in each test event. The score of 50 was designated to represent the anticipated average performance of the men as they entered the program. The scores range from zero to 100 as performances fall below or exceed this level.

At the end of each term reports are submitted from each AST unit. Although individual performances are not reported, average scores for each class are submitted separately, making it possible to follow the progress of each new contingent of men through successive terms of training. It is from these reports that the data here submitted were obtained.

ASTP TRAINEES

The study of the older group of *ASTAP* trainees includes all soldiers who were trained under the ASTP between 12 April 1943 and 1 April 1944 except (1) professional trainees (medical, dental, veterinary) who did not participate regularly in the physical training

program; and (2) a few groups of trainees concerning whom reports were not in usable form for the purposes of this study.

The ages of ASTAP trainees ranged from 18 years to 38 years. The first class (April, 1943) averaged 24 years. Later contingents contained larger percentages of younger men, reducing the average age. The wide spread in age continued, but the older men were proportionately fewer in each successive class. In the class which began training in January, 1944, the last class included in this study, the average age was 20.2 years.

In general, as would be expected, younger men made higher scores than older ones.

The greatest improvement was consistently made in the first term. Thereafter gains decreased as men approached their peak performances for the type and amount of training offered.

Those entering the program during the earlier months of its existence did not score so well either in the initial tests or in subsequent tests as did those admitted later. The reasons for this are thought to be (1) emphasis at the outset on advanced phases of academic training which brought into the program men of relatively higher average age; (2) selection procedures which resulted in relatively higher percentages of limited service personnel during the earlier months of the program; (3) the introduction of the STAR units where physical training was a part of a program given to a trainee prior to his assignment to a regular AST unit; (4) elimination or reduction of the time lag between the completion of Basic Military Training and assignment to the ASTAP; (5) improved physical training in schools, colleges, and other civilian agencies, which produced better raw material for the later classes.

Results of the physical efficiency tests for ASTAP trainees from April, 1943, to April, 1944, are shown in consolidated form in Table I. The tests were administered during the first or second week of training and near the close of each 12-week term. A total of 126,471 took the initial test during the period covered by this study, but because of graduations and separations from the program for other reasons, not all who took the initial test were available for subsequent testing. This is particularly true of the first contingent of trainees who were admitted in April, 1943. In all, 78,260 of those initially tested were available for the last tests included in this study.

The earlier classes made a grand average point score of less than 50 in the initial test. The later classes exceeded that score. When results from all the entering classes are considered together, the grand average point score for the initial test is exactly 50, precisely the score that was anticipated when the scoring table was constructed.

TABLE I

RESULTS OF PHYSICAL EFFICIENCY TESTS
ADMINISTERED TO
TRAINEES IN THE ARMY SPECIALIZED TRAINING PROGRAM
April 1943 — April 1944

Terms of Training Received	*Number Tested Initial Test*	*Average Point Score Initial Test*	*Average Point Score Last Test*	*Improvement in Point Score*	*Number Tested Last Test*
4 terms (April 1943 to April 1944)	2,949	44	71	27	709
3 Terms (May, June, July to Jan., Mar., April)	36,314	49	72	23	17,290
2 Terms (Aug., Sept., Oct. to Jan., Mar., Apr.)	62,919	51	71	20	39,257
1 Term (Nov., Dec., Jan. to Jan., Mar., Apr.)	24,289	54	68	14	21,004
TOTAL	126,471	50			78,260

Table II shows in greater detail the performances during the initial term of training (April, 1943, to July, 1943) of the first contingent of ASTAP trainees assigned to the program. Perhaps a more complete picture of the improvement in physical efficiency of these groups of soldiers may be obtained from a study of the detailed scores of this sample class.

TABLE II

RESULTS OF PHYSICAL EFFICIENCY TESTS
ADMINISTERED TO
FIRST CONTINGENT OF TRAINEES IN THE ASTP
DURING
FIRST TERM OF TRAINING
April 1943 — July 1943

	Initial Test	*First Term-end Test*	*Gain or Loss*
Number Tested	2949	2577	-372
Average Age	24.1	24.3	.2
Average Height	68.7	68.7	.0
Average Weight	157	158	1

Item	Average Raw Scores			Average Point Scores		
	Initial Test	*First Term-end Test*	*Gain*	*Initial Test*	*First Term-end Test*	*Gain*
Push-ups	18.0	22.8	4.8	50	60	10
Squat-jumps	30.7	38.6	7.9	45	61	16
Sit-ups	32.0	41.4	9.4	44	56	12
Pull-ups	5.5	7.1	1.6	45	59	14
100-Yd. P A.B.	27.0 secs	24.6 secs	2.4 secs	42	61	19
Squat-thrust 20.	9.8	11.4	1.6	39	64	25
300-Yd. Shuttle	47.1 secs	44.4 secs	2.7 secs	41	60	19
Physical Efficiency Rating (Grand Average Point Score)				44	60	16

ASTRP STUDENTS

The study of ASTRP students includes all reservists (Enlisted Reserve Corps, unassigned, and Air Corps Enlisted Reserve) whose instruction under the ASTRP began 12 June, 10 July, or 7 August 1944.

These students are products of the high schools and preparatory schools of the country for the year 1944. However, it must be borne in mind that the qualifications for the ASTRP automatically eliminate three classes of secondary school graduates: (1) those who are under 17 years of age or over 17 years 9 months when training begins; (2) those who are unable to pass the Army's physical examination for general service; and (3) those who fail to score the equivalent of 100 or better on the Army General Classification Test.

The present study covers only the first term, including the initial test and the first term-end test. Testing procedures were the same for ASTRP students as for ASTAP trainees except that the former were given the initial test during the fourth week of training rather than during the first or second week. Although later the initial test for both groups was conducted during the fourth week, the initial test for ASTAP trainees included in this study was administered during the first or second week of regular ASTAP training.

Because of separations from the program for various reasons, approximately 10 per cent of those to whom the initial test was administered were not available for the term-end test. The numbers tested, the average age, height, and weight, the average performances in each test event (raw scores), the average point scores in each test event, and the physical efficiency rating (grand average point scores for all events) at the time of these first two tests, and the gains or losses between the two test dates are shown in Table III. In actual practice a revised scoring table was adopted as the reserve program

came into prominence. The average scores reported in Table III, however, are here converted to point scores by means of the original scoring table to provide a means of comparison with results shown in Table I and II for the older ASTAP trainees.

TABLE III

RESULTS OF PHYSICAL EFFICIENCY TESTS
ADMINISTERED TO
ASTRP STUDENTS, DURING INITIAL TERMS OF TRAINING
Beginning 12 June, 10 July, and 7 August and ending
2 September, 30 September, and 28 October 1944

	Initial Test	*First Term-end Test*	*Gain or Loss*
Number Tested	13,623	12,307	-1316
Average Age	17.5	17.7	.2
Average Height	69.1	69.3	.2
Average Weight	147.7	150.8	3.1

	AVERAGE RAW SCORES			AVERAGE POINT SCORES		
Item	*Initial Test*	*First Term-end Test*	*Gain*	*Initial Test*	*First Term-end Test*	*Gain*
Push-ups	21.6	27.1	5.5	57	68	11
Squat-jumps	42.0	52.8	10.8	68	80	12
Sit-ups	43.1	59.5	16.4	58	74	16
Pull-ups	6.1	7.5	1.4	51	62	11
100-Yd. P.A.B.	25.0 secs	23.3 secs	1.7 secs	58	70	12
Squat-thrust 20.	11.3	13.0	1.7	63	90	27
300-Yd. Shuttle	45.2 secs	43.6 secs	1.6 secs	55	64	9
Physical Efficiency Rating (Grand Average Point Score)				59	73	14

CONCLUSION

The improvement in physical efficiency (as reflected by the test scores) of all classes under the ASTP, whether ASTAP or ASTRP, was approximately the same. This marked uniformity in improvement is indicated not only by the accompanying tables, but also by every other study that has been made of these groups in which numbers were large enough to provide a fair sample. One might have expected those classes which made the lowest initial scores to have improved the most. This no doubt was true of many individuals but when large groups are studied the differences in improvement are not significant. Perhaps this is to be explained by the fact that the lower initial scores were made by the older groups of men, who could naturally be expected to improve more slowly than the younger men. Thus there may have been two opposing sets of circumstances the effects of which tended to offset one another. Whatever the explana-

tion, whether or not in the initial test the average score for a class was relatively high or low, the average score at the end of one term of training was always 13 to 16 points higher. Improvement during the second term was uniformly from 6 to 8 points and thereafter from 3 to 4 points per term.

It is fully appreciated that a well ordered program of physical training contributes to the mental and emotional development of the participant, as well as to his physical development. This study, however, is concerned solely with measurable improvement in such elements of physical efficiency as strength, agility, coordination, speed, and endurance. The data here presented clearly indicate that for groups of men of military age a predictable and reasonably uniform average improvement in these elements can be expected from a sound, six-hour-a-week program of physical training conducted under conditions providing for regularity in food and sleep. These data also indicate that, although age is a factor in determining the level of physical efficiency, it does not appear to be significant, among the age groups studied, in determining the degree of improvement to be expected from such a program.

The Influence of Aging on Power and Endurance in Man

By

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(Submitted for publication, January, 1945)

INTRODUCTION

OWING at least in part to the fact that the average duration of human life is increasing, attention is being directed more and more to problems dealing with old age. Among these problems is the relation of age to physical effort.

This relation is of importance to many persons: to physical educators who are increasingly called upon to prescribe for the elderly in the interest of hygiene; to the expert in physiotherapy, who must prescribe curative and corrective exercises for those persons who are both ailing and elderly; to the efficiency engineers, whose interest it is to know how much physical exertion can be expected from elderly workers; and to all those of us who are interested in what our own futures have in store.

There are two ways of conducting an inquiry into the effects of age, namely, the statistical study of different age groups, and the study of individuals as they progress from decade to decade. The second way is that adopted in this article.

It is unfortunate that on the present occasion we are dealing with but a single subject and also that the data presented are so fragmentary. In explanation of the latter fact, it may be stated that the decision to construct a connected history did not occur to the writer until late in life. In fact I think that it was my visit to the Moskow "age clinic" of the late professor I. G. Gelman in 1935-36 that finally fixed my attention on this matter and led to the experiments of Dr. Hellebrandt and myself in 1941.[2*] Then and since then old records published and unpublished were sought and new experiments performed. The inadequacy of the material has not, however, prevented me from presenting it for it is hoped that it may prove suggestive to later workers.

This article is an account of the work done on one subject only. It is felt, however, that the publication of the material is timely since data in this age range are scarce and this is an area of research upon which more study needs to be done.

*** Superior figures refer to numbered bibliography at end of article.**

In some respects that part of my age-capacity curve covering the coming years will be the most interesting, provided it is not spoiled by irrelevant illnesses.

THE SUBJECT

Medical history.—This may be divided into three periods. In the first, there are besides the usual diseases of childhood, frequent attacks of bronchitis in winter, culminating at sixteen years with pneumonia, soon followed by grip and appendicitis (unoperated). The second period begins at seventeen years with a change of climate and the development of great bodily vigor. Later follow in succession temporary but complete incapacity from "flat" feet at 28, two major attacks of sacro-iliac trouble, whooping cough at 37, first attack of arthritis (feet) 43, diabetes detected at 44 (recovered from in 5 or 6 years of dieting), and broncho-pneumonia (hospital) at 49. The third period is largely of surgical interest. Tonsillectomy and umbilical hernia (small) at 52, intestinal obstruction (severe with laparotomy) at 56, excision of the gall bladder at 67, transurethral prostatectomy with complications at 69. From early manhood there were circulatory disturbances of the extremities which increased in severity with age.

The picture is one of varied and frequent disorders both acute and chronic, but the subject has always recovered rapidly from the former and been only moderately handicapped by the latter.

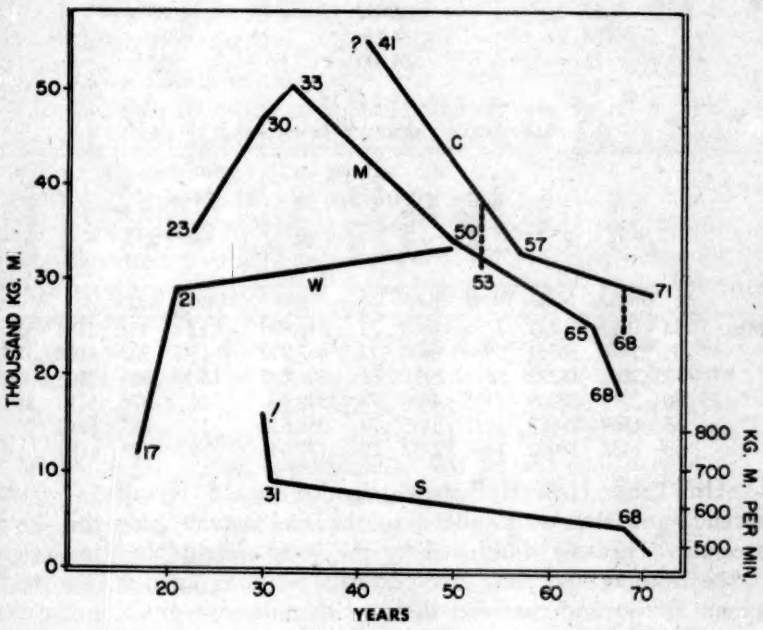
Athletic history.—In connection with nature study, the subject hiked a good deal as a boy; in college he was in continuous training for four years for lacrosse (the old-fashioned game); the 3-mile run was continued until the age of 41, and after that tennis, calisthenics, mountain climbing were continued and dumb-bells, rope skipping, and badminton begun, together with more or less strenuous riding on the cycle ergometer.

In all forms of competition whether against human opponents or against his own records, the subject was accustomed to "all-out" efforts, working for each point as it came along but often quite oblivious of the total score. This habitually competitive attitude is of great value in such experiments as those to be described.

EXPERIMENTS AND OBSERVATIONS

The material which has been accumulated consists of four sets of observations: (1) on cycle-ergometer rides (a brief summary of experiments are described in detail elsewhere[1, 2, 3]); (2) on long continued mountain climbing (endurance); (3) on short, brisk mountain ascents (speed); (4) on road walking.

This material is presented essentially in a figure with its legend, in some tables which amplify the figure, and in a series of notes, which add a little more detail for the benefit of the more analytical or more curious reader.



Numbers arranged vertically on the left correspond to curves C. M. and W.; those on the right to curve S only. The numbers along the abscissa are decades of the subject's age. All the numerals scattered among the curves also indicate the age of the subject; the information which they give is but a repetition of that given along the abscissa but nevertheless they are added for convenience. C. is cycle ergometer; M. mountain climbing (endurance)—52 and 65 at high altitude, base 2718 m. (9,000 ft.); all the remaining items are at low altitude, base 447 m. (1300 ft.); S., mountain climbing (speed), low altitude; W., walking on level, low altitude. In calculating, one meter of ascent is taken as equal to 15 meters on the level. The rides on the cycle ergometer were all for 30 min. excepting the test ride at 41 years which was for 18 min. Consequently the point ("C 41") chosen for it on the curve is conjectural ("?") though reasonable. ! indicates that, on climbing at this speed, the subject collapsed (at the end of 35 min.). In regard to the years 20 and 31 there is some doubt; perhaps the events occurred in the same year which may have been either 30 or 31, or perhaps the years or events have been reversed in the figure. This is not significant.

TABLE I

CYCLE ERGOMETER

Age	*Work, total* kg.m.	*Work per min.* kg.m.
41	55,000	1830
53	31,545	1051
57	32,682	1089
68	24,490	850
71	28,600	953

TABLE II

MOUNTAIN CLIMBING (ENDURANCE)

		Real ascent	*Distance (level)*	*Virtual ascent*	*Total ascent*	*Body and pack wt.*	*Work*	*Time*	*Work per min.*	*Real ascent*	*Distance (road)*
		Mets.	Mets.	Mets.	Mets.	kg.	kg.m.	Hours	kg.m.	Ft.	Miles
Mtn.	23	1062	56341	3756	4818	72	346,896	12	482	3484	35
"	31	2470	58951	3930	6400	73	467,200	15.5	502	8102	37
"	33	3812	48292	3219	7031	72	506,232	13-14	608	12505	30
"	50	2015	38939	2595	4600	74	340,400	16	378	6610	24
"	65	1564	28975	1931	3495	74	258,630	16	287	5130	18
"	68	1457	18992	1266	2732	72	177,041	9	327	4780	11.8

In Table II level distance divided by 15 is called "virtual ascent" and this when added to the real ascent gives the "total ascent." This last multiplied by the body weight plus the weight of the clothing and pack gives external work in kg.m. The "real" ascent in feet and the level distance in miles are given in the last two columns on the right. The "time" is that actually spent in progression.

TABLE III

MOUNTAIN CLIMBING, SPEED

Age	*Body-pack wt.*	*Time of ascent*	*Ascent per hr.*	*Work/ hr.*	*Work/ min.*	*Distance level/ hr.*	*Virtual ascent/ hr.*	*Total ascent/ hr.*
(yrs.)	(kg.)	(min.)	(m.)	(kg.m.)	(kg.m.)	(m.)	(m.)	(m.)
30	70	34*	733	51,310	855	.....	....	.....
31	70	106	580	40,600	677	.....	....	.....
68	70	170	475	33,250	559	1380	92	567
71†	72	196	409	29,448	491	1200	80	489

Total work/hr. (kg.m.)	*Total work/min.* (kg.m.)	*Ascent/hr.* (ft.)	*Ascent/min.* (ft.)
.....	.....	.....	.....
.....	.....	.....	.....
39,690	660	1554	25.9
25,102	585	1344	22.4

* Collapse (see text on "Speed 30").
† Questionable results (see text on "Speed 71").

TABLE IV

WALKING

Age (yrs.)	*Virtual* ascent* (m.)	*Body-pack wt.* (kg.)	*Work* (kg.m.)	*Distance* (miles)	*Time approx.* (hrs.)
16	1826	66	120,517	17	5-6
21	4061	72	292,392	35	10
50	4829	70	336,030	45	13

* Refer to explanation of Table II.

Notes.—In the following notes, the numerals correspond to those already used in the figure and tables. For example, cycle 41 means ride on the cycle-ergometer at 41 years.

Cycle 41. The element of conjecture in respect to this ride is referred to in the legend of the figure. The preparation for this test ride consisted of the 3-mile run performed on 13 occasions. Cycle 53 was a single test ride following a series of long walks. The amount of walking was not recorded but could not have been much less than that done at 50. Then during the autumn and winter the subject walked once a week. In the first 58 days there were 12 walks which totalled 727 k.m. (450 miles). Later the snow reduced the distances but increased the effort. At 53 the "condition" of the subject was excellent but he had had little practice in riding and this doubtless operated to reduce the tempo. Cycle 57. Here the test ride had been preceded by twenty or more similar rides. Cycle 68. Here the preparation consisted in mountain climbing at a low base altitude, 396 m. (1300 ft.) to which was added two rides on the cycle ergometer. As in the case of Cycle 53, the preparation seems to have been inadequate. At any rate the score was poor in both rides. Cycle 71. Here the test ride was preceded by a series of 17 rides, and the plateau of the learning curve had been reached.

Mtn. 23. An Adirondack trip from Lake Placid (Stevens House) to summit of Mt. Marcy and return. Sixteen k.m. (10 miles) of road, breakfast at Adirondack Lodge, about 12 k.m. (7.5 miles) of obscure trail with slow guide. The subject did much running along the road during the return. Mtn. 31. An Adirondack trip from Beede's over "Gothic," etc., to "Haystack," returning the same way past St. Hubert's Inn, and on to New Russia by the old Chapel Pond road. There was a hard storm on the summits. The subject was very tired. This may have been at 30 years instead of at 31. Mtn. 33. A White Mountain trip from Randolph, N. H., to Mt. Madison summit, by "White Trail" to Pleasant Dome and back the same way to Randolph. The weather was cool and cloudy. The effort was well borne and several days for recovery were necessary. This trail is not the "Gulf-side Trail." The "White

Trail" used to be marked only by splotches of white paint on the rocks and followed the watershed. The diet during this summer was largely carbohydrate and was meat free. Mtn. 50. A trip in Rocky Mountain National Park, Colorado, from Ding's Cottage (near Longs Peak Inn) via Storm Pass and Andrews Glacier to the summit of Mt. Taylor and return via Flat Top, Bear Lake, and Storm Pass. The weather was excellent. Butter played the major role as a source of energy at this time because of the diabetes above mentioned. Mtn. 65. This was in the same region from Hewes-Kirkwood Inn via Wild Basin to Mt. Pagoda summit and return the same way. Seven or more hours of this 16-hour trip were over very rough country without trail. Mtn. 68. This was a trip from Mt. Crescent House, Randolph, N. H., to the summits of Mt. Madison and Mt. Adams and return via Spur Brook.

Speed 30. Adirondack Mountains, N. Y., from near New Russia toward summit of Iron Mountain. The sprint terminated unexpectedly and abruptly. After lying on ground for half an hour, the subject returned home. On several other occasions a similar collapse has occurred but unfortunately this is the only one for which figures were obtained. Speed 31. This was in the same region from near New Russia over Giant to the Sachs' place in Keene Valley and return. The record was made while ascending Giant on the return trip. Speed 68. White Mountains, N. H.: trip began and ended at Mt. Crescent House, Randolph. Timing was from the railway track at Appalachia to the summit of Mt. Adams via air line trail over Durand Ridge. Speed 71. This experiment is unsatisfactory. It was hoped to repeat at 71 the ascent made at 69 but the physical conditions of the terrain were unfavorable (late Oct.). As it was, the subject climbed 1255 m. (3805 ft.) in 3 hours and if the rate had been continued, he would have reached the summit 1453 m. (4405 ft.) above the railroad, in 16 minutes more. This speed could easily have been kept up (or even increased slightly) but for snow and clouds. The score would then have shown a drop to 88 per cent of that at 68. A drop of 12 per cent in three years is possible. More likely actual speed would have been greater but for the ice and water on the trail actually traversed. But the difference might have been small.

For all these mountain records except that at 71 the preparation was considerable, namely, a couple of months of climbing. At 71 the record was made on the 26th day from the start at "scratch" and it should be recalled that the older the subject, the longer it takes to reach his maximum grade of fitness, i.e., the slower the rise to maximum of the learning curve.

Walk 16. From Pittsfield, Mass., to Lebanon Springs and return,

taken alone and timidly over a good dirt road. The subject was unaccustomed to long distances and this was not a maximum effort. Walk 21. From Roxbury, Delaware Co., N. Y., past Grand View Hotel and return. This was the effort of a well trained walker. There was a good dirt road, but the effort was fatiguing. Walk 50. Twice around Lake Mendota, Madison, Wis. This was a good road, mostly dirt, and the weather was excellent. The preparation for this walk was not the best. It consisted in a vacation in the Rocky Mountain National Park with much climbing but not much road walking. It is known that road walking following mountain climbing may be abruptly terminated by cramps. I record the case of a Yale student who climbed Mt. Washington, N. H., three times in 24 hours. After an adequate rest he undertook to walk around the Presidential Range 96.6 k.m. (60 miles) in 24 hours, a strenuous but not an astounding task, but broke down with cramps before he had gone 24 k.m. (15 miles) so that he had to use crutches for several weeks. By the end of Walk 50 my own calves had begun to feel queer and I believe that I got home just in time to avoid trouble.

SUMMARY

The outstanding facts presented above may be summarized as follows:

The highest record on the cycle ergometer was at 41 years; that at 57 was 60 per cent of this; and that at 71, 50 per cent.

The highest record for long mountain climbs (endurance tests) was made at 33 years; that at 23 was 68 per cent of this; and that at 68 was 35 per cent. Here the base level was 396 m. (1300 ft.). With a base level of 2718 m. (9,000 ft.) the highest record was at 50 years and that at 65 was 75 per cent of this.

The longest walking distance was at 50 years; that at 21 was 87 per cent of this.

The maximum speed ascending occurred at 31. An increase of 25 per cent above this maximum led to collapse (at 30 years). The speed at 68 was 82 per cent of the maximal speed and that at 71, about 71 per cent.

The observations with the cycle ergometer are the most accurate and the most carefully studied. They are described elsewhere[1, 2, 3] in greater detail. The remaining observations have not been presented before. It is to be remembered that the cycle ergometer, though more open to exact study, is a more artificial form of exercise than the others.

REFERENCES

1. Dawson, Percy M., 1919, *Am. J. Physiol.*, 50:443.

2. Dawson, Percy M., and Frances A. Hellebrandt, 1942, *Proc. of Fed. of Am. Sc. for Exper. Biol.* 1:1:39; also 1945, *Am. J. Physiol.*, 143:420.

3. McCrea, F. D., J. A. E. Eyster, and W. J. Meek, 1928, *Am. J. Physiol.*, 83:678.

The Validity of Health Information Gained Through Radio Advertising

By

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(Submitted for publication, November, 1944)

THE significance of the radio as a source of information, entertainment, and public control has become increasingly evident during the last two decades. In fact, it outranks at present every other agency of public opinion. Commercial, political, religious, and moral interests all accept it as of first importance in the control of the attitudes and opinions of the general public.

When a new and important agency such as this comes into being it is bound to call for new legislative and other restrictions in order that the general interests of the public may be served. To what extent such curbs are necessary has not yet been fully realized. For one thing, it is difficult to determine the precise manner in which a particular appeal is able to affect its listeners.

Where the buying habits of the public are involved we do not become greatly concerned unless the article offered for sale may be detrimental to the individual's well being. But it is in this respect that much damage has been, and still is being done, through dramatic, sensational, and often misleading appeals. Drugs are being offered for sale which are of doubtful value and sometimes actually deleterious to the individual's health.

THE PROBLEM

The present study[1] was undertaken to determine the extent to which selected groups of people accept the health information conveyed through the commercials of radio programs. It had as its aim the determination of (a) differences in response and acceptance of radio appeals at different educational levels, and (b) the validity of these appeals as determined by the views of specialists.

PROCEDURE

The material of the study was taken in shorthand directly from the commercials which were broadcast on programs sponsored by manufacturers of four different groups of products: (1) those relat-

[1] A more complete report of this study is found in the doctoral dissertation of Gertrude I. Duncan entitled "The Validity of Health Information Gained Through Radio Advertising," a copy of which can be secured by applying to Temple University Library.

ing to the maintenance and improvement of the health of skin, hair, and teeth; (2) those relating to the health of the respiratory organs; (3) those relating to the health of the digestive, assimilative, and excretory functions; and (4) those relating to pain relief and general health.

The key appeals were selected from the commercials re-worded in some cases and submitted to four groups of judges for evaluation on a five-point credibility scale.

The statements were submitted for scoring to the following groups of judges:

I. 20 experts: physiologists, chemists, dermatologists, physicians, dentists

II. 10 teachers of health and physical education

III. 18 graduate students

IV. 30 laymen: housewives, laborers, farmers

The rating scale employed in the evaluation follows:

5—true

4—possibly true

3—do not know—cannot determine

2—possibly false

1—false

PRESENTATION OF DATA

The following are samples of the statements (236 in all) submitted to each of the groups by the judges. The ratings in this case are the ones obtained from experts (Group I).

TABLE I

STATEMENTS ACCEPTED AS TRUE (RATINGS 5 TO 3.6) BY EXPERTS

Average Rating	*Statement*
4.7	With Certo your jellies will jell quickly.
4.2	Pancakes made with Aunt Jemima's Pancake Flour are nourishing.
3.7	Post's Bran Flakes promote health and regularity.
3.6	You should take home Horn & Hardart's ready-to-eat meals because you get quality at minimum cost and trouble.
3.6	Four-Way Cold Tablets, made with aspirin, will relieve aches and pains.

STATEMENTS REGARDED AS DOUBTFUL (3.5 TO 2.5) BY EXPERTS

Average Rating	*Statement*
3.4	20 Mule Team Borax, when used in cleaning, leaves the skin smooth and soft.
3.4	Pancakes made from Aunt Jemima's Pancake Flour are easily digested.
3.0	Swans Down Cake Flour makes your cakes come out luxurious and delicious at minimum cost.

2.9	Commonwealth Opticians can fit you with glasses scientifically and accurately for $7.00 (June, 1941).
2.8	Four-Way Cold Tablets will relieve stomach ills because they contain magnesia.

STATEMENTS CONSIDERED FALSE (RATINGS 2.4 TO 1) BY EXPERTS

Average Rating	*Statement*
2.0	Pepsodent Tooth Powder produces 32% more luster than the average tooth powder.
1.9	Crax (a food) is the greatest buy on the market.
1.8	Woodbury Soap will give you a radiant and glamorous skin.
1.6	Smith Brothers Cough Drops give immediate relief from coughs.
1.3	People who are thirty-five or over need special help provided by Serutan (laxative).

TABLE II

PER CENT OF STATEMENTS REGARDED BY EXPERTS AS TRUE, DOUBTFUL OR FALSE

	True Statements	*Doubtful Statements*	*False Statements*
Skin, hair, teeth	00.00%	61.20%	38.80%
Respiratory organs	6.68%	46.66%	46.66%
Digestive functions	9.70%	61.20%	29.10%
Pain relief, general health	5.00%	40.00%	55.00%
Per cent of total	6.36%	58.48%	35.16%

TABLE III

PER CENT OF STATEMENTS REGARDED BY LAYMEN AS TRUE, DOUBTFUL, OR FALSE

	True Statements	*Doubtful Statements*	*False Statements*
Skin, hair, teeth	46.27%	50.75%	2.98%
Respiratory organs	53.33%	46.67%	00.00%
Digestive functions	40.30%	50.75%	8.95%
Pain relief, general health	25.00%	60.00%	15.00%
Per cent of total	41.53%	51.27%	7.20%

TABLE IV

COMPARISON OF RATINGS OF THE FOUR GROUPS OF JUDGES FOR ALL STATEMENTS

Judges	*Percentage True*	*Percentage Doubtful*	*Percentage False*
Experts	6.36	58.48	35.16
Teachers	6.78	40.68	52.54
Graduate Students	11.86	63.14	25.00
Laymen	41.53	51.27	7.20

CONCLUSIONS

1. In the main, the statements employed by advertisers in relation to the products studied are regarded either as false or as of

doubtful validity by the experts and graduate students.

2. The statements or claims made in connection with products designed to improve digestion and elimination enjoy the highest degree of acceptance by experts, those relating to care of the skin, hair, and teeth, the lowest.

3. There is a negative relationship between educational status and acceptance of radio advertising.

4. Generally speaking, claims made regarding different product groups are given a higher rating on the credibility scale by those of lower socio-economic status (skilled and unskilled workers) than by those of high socio-economic status (professional men and women); hence the advertising would appear to be most effective with the former.

A Short Screen Test for Predicting Motor Fitness

By

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(Submitted for publication, December, 1944)

DIFFICULTY IN FINDING A SHORT MOTOR FITNESS TEST

THERE is a great need for a simplified motor fitness classification test which can be administered indoors, without using special or expensive equipment, and which can be given by one instructor in about 30 minutes. An extremely short test is possible only by omitting some of the types of items, thus losing part of what is sampled in a longer test. Also, with fewer items there is not only lower validity but poorer reliability. The "pass" or "fail" procedure permits saving considerable time but necessitates the use of bi-serial and tetrachoric correlation coefficients, which have poorer reliability, inducing computational difficulties in subsequent multiple regression or factor analysis work used to weight or group the items in a matrix.[1] Both of these procedures can be carried out and are useful for approximate results, probably not finer than one place to the right of the decimal in this problem.

Another difficulty is the great difference of opinion over what should be measured. Some experts confine their interpretation of physical fitness to muscular endurance. Others to cardiovascular endurance. A great majority of physical educators favor including fundamental elements of motor ability, such as balance, agility, strength, power, etc. Some have preferred strength alone as a basis. Then still others have focused upon power activities which combine speed and strength, as in the broad jump, shot put, ball throw for distance, high jump, etc. A few others have been unwilling to omit items which permit measuring physiological aging, such as blood pressure and flexibility items. Finally, a great number of administrators are willing to accept a short and simple test which can be administered without expense or trained personnel.

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* The computations in this paper have been executed in duplicate throughout by Cornelia Morgan with all calculations on a Monroe calculating machine.

1 The basic data used in this study are of this type, necessitated by short periods of 30 minutes each and large classes which made careful measurement of each and every trial impossible.

SCHEME OF VALIDITY USED IN THIS RESEARCH

The basic criterion correlations used in this study are bi-serial correlations obtained by correlating each item in a series of pass or fail tests with the composite scores made by the same subjects on a 30-item criterion.[2] This criterion was formulated on the basis of five items of varying difficulty in each of six areas of emphasis, namely, balance, flexibility, agility, strength, power, and endurance. On the basis of proportions of failures, each item in each category was weighted in terms of points. The areas of emphasis were also weighted so that balance items could contribute a possible total of 100 points, flexibility items, 100 points, agility items, 100 points, strength items, 200 points, power items, 200 points, and endurance items, 300 points. The composite scores ranged from 50 to 1000 points with the mean 526.75 points and the σ 167 points. A very close approximation to a true normal distribution resulted. The authors believe after using several types of criteria that this method gives the most satisfactory and inclusive criterion yet devised. Thirty items are more than usually employed; the major emphasis is upon strength, power, and endurance events; and yet fundamental body control items are included at lesser weighting in the areas of balance, flexibility, and agility.

The intercorrelations are of the tetrachoric type computed with the aid of Thurstone's computing diagrams[3] (Table I). The intercorrelations are shown for the items in the University of Illinois (14-Item) Motor Fitness Test, the items of which were derived from correlations with the 1000-point, 30-item criterion. The items selected for the 14-item test include the relatively highest items in the six categories: balance (1), flexibility (2), strength (3), agility (4), power (5) and endurance (6).[4]

The testing of several thousand young men with the 14-item test during 1942 and 1943 produced valuable results.[5] The test required one hour with each group of the new students under each instructor.

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2 T. K. Cureton, "A Criterion for Motor Fitness," *The Physical Educator*, 3:64-74, (Jan., 1943). The bi-serial formula is the Richardson-Stalnaker form: $r_{bis.} = \frac{M_2 - M_1}{\sigma}\sqrt{pq}$.

3 L. Chesire, M. Saffir, and L. L. Thurstone. *Computing Diagrams for the Tetrachoric Correlation Coefficient.* (Chicago: The University of Chicago Bookstore, 1933.)

4 T. K. Cureton. *Physical Fitness Workbook.* (Champaign, Illinois: Stipes Publishing Co., 1944.) Pp. 11-29. Also, *Scholastic Coach*, 13:40-44, (Oct., 1943).

5 T. K. Cureton, "The Unfitness of Young Men in Motor Fitness," *Journal of the American Medical Association*, 123:69-74, (Sept. 11, 1943).

With very large numbers of subjects there is need for a test which can be administered in about 30 minutes. The purpose of this research is to determine the predictive value of various combinations of items within the scope of the available data, so as to determine whether a shorter test is feasible.

TABLE I

MATRIX OF INTERCORRELATIONS*
FOR THE ILLINOIS MOTOR FITNESS SCREEN TEST

	Foot and Toe Balance (10 sec. each)	Squat Stand Balance (10 secs.)	Trunk Extension Flexibility (18")	Trunk Flexion Sitting (6")	Extension Press-Up Strength (once)	Man-Lift and Let-Down (10 secs.)	Leg-Lifts and Sit-Ups (20 each)	Medicine Ball Put (34')	Dive and Roll Agility (5')	Breath Holding After 2' Run 30 (secs.)	Bar Vault Agility 4'-6"	Chinning the Bar (8 times)	Standing Broad Jump (6'-2")	Mile Run (7 min.)	Composite 30-item Criterion
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	0
1. Foot and Toe Balance	.95	.07	.00	.14	-.05	.16	.45	.53	.39	.04	-.04	.19	-.10	.17	.38
2. Squat Stand Balance		.92	.10	.03	.31	.59	.38	.06	.49	.17	.52	-.12	.04	.43	.45
3. Trunk Extension Flexibility			.94	.20	.20	.40	-.04	.00	-.19	.35	.30	.30	.10	.20	.20
4. Trunk Flexion Sitting				.95	-.13	.58	.17	-.15	.15	.12	.34	.25	.18	-.01	.18
5. Extension Press-Up Strength					.95	-.02	.39	.19	.07	.18	.47	.24	.17	.16	.37
6. Man-Lift and Let-Down						.87	.09	.23	.27	-.03	.22	.06	.30	.19	.26
7. Leg-Lifts and Sit-Ups							.87	.32	.29	.42	.23	.24	.46	.45	.41
8. Medicine Ball Put								.95	-.09	.20	.08	.00	.22	.07	.38
9. Dive and Roll Agility									.95	.13	.32	.21	.35	.10	.48
10. Breath Holding After Run										.80	-.11	.08	.30	.00	.30
11. Bar Vault Agility											.95	.18	.27	.37	.44
12. Chinning (either grip)												.95	.12	.27	.44
13. Standing Broad Jump													.90	.16	.28
14. Mile Run														.95	.43
M														526.75	
σ														167	
N														171	

* All of these except the biserial criterion correlations are tetrachoric correlations computed from Cheshire, L. M. Saffir, and L. L. Thurstone.

STATISTICAL RESULTS

The findings are shown in Tables II, III, and IV. The relative net contribution of the items to the 30-item criterion is shown in Table II, proportional for each item to the squared betas. This statistical analysis of motor fitness shows that the net relative predictive value of the items to the criterion are in order: Dive and Roll, Medicine Ball Put, Bar Vault, Chinning, Leg-Lifts and Sit-Ups, Breath Holding after Running in Place 2 Min., and Man-Lift and Let-Down. These seven events are combined for a short Motor Fitness Test. The R is .78 in predicting the 30-item criterion.

TABLE II

PROPORTIONATE NET CONTRIBUTION OF THE ITEMS TO THE CRITERION

Test Items	*Notation*	*Betas**	*Betas Squared*	*Proportionate Net Contribution*
Mile Run	Beta 14	-.1121	.0125	1.4%
Standing Broad Jump	" 13	-.2923	.0854	9.7%
Chinning	" 12	.3202	.1025	11.5%
Bar Vault	" 11	.3545	.1257	14.2%
Breath Holding After Run	" 10	.2088	.0436	4.9%
Dive and Roll	" 9	.4441	.1972	22.2%
Medicine Ball Put	" 8	.3848	.1481	16.7%
Leg-Lifts and Sit-Ups	" 7	.2362	.0558	6.3%
Man-Lift and Let-Down	" 6	.2023	.0409	4.6%
Extension Press-Up	" 5	.0010	.0000	0%
Trunk Flexion	" 4	-.1389	.0193	2.2%
Trunk Extension	" 3	.0277	.0008	.1%
Squat Stand	" 2	-.1352	.0183	2.1%
Foot and Toe Balance	" 1	-.1910	.0365	4.1%
		$\lesssim B^2$'s =	.8866	100.0%

* Reasons why these negative betas appear are not fully known. They usually appear with those items having small negative signs in the basic correlations and are either due to sampling errors or a true negative relationship which was not reflected. The betas with negative signs hurt the prediction by lowering the multiple R. None of these items was selected in the final test.

TABLE III

RELATIVE PER CENT CONTRIBUTION OF EACH ITEM

Betas		*Item*	*Per Cent, Net Contribution*	*Classification*	*Body Emphasis*
Beta	9	Dive and Roll	22.2%	Agility	Over-all Control of Position
Beta	8	Medicine Ball Put	16.7%	Power	Over-all Extension Power
Beta	11	Bar Vault	14.2%	Agility	Over-all Control of Position
Beta	12	Chinning	11.5%	Endurance	Arms, Shoulders, and Back
Beta	13	Standing Broad Jump	9.7%	Power	Legs and Back Extensor Power
Beta	7	Leg-Lifts and Sit-Ups	6.3%	Endurance	Abdominals and Thigh Flexors
Beta	10	Breath Holding After Run	4.9%	Endurance	Blood and Respiratory Strength
Beta	6	Man-Lift	4.6%	Strength	Lifting Strength (arms, back, legs)
Beta	1	Foot and Toe Balance	4.1%	Balance	Kinesthetic Sense of Position
Beta	4	Trunk Flexion	2.2%	Flexibility	Neck, Back, Hip Flexibility
Beta	2	Squat Stand	2.1%	Balance	Kinesthetic Sense and Strength
*Beta	14	Mile Run	1.4%	Endurance	Foot, Leg, Back, & Heart Muscles
*Beta	3	Trunk Extension	.1%	Flexibility	Chest and Hip Flexibility
*Beta	5	Extension Press-Ups	.0%	Strength	Shoulder, Chest, & Hip Strength
			100.00%		

* The low relative net contribution of the mile, trunk extension, and extension press-ups means that these events contribute little to the 30-item criterion that is not already contributed by the other events in the series. If other similar events were dropped out, then these three events would probably increase in proportionate contribution. The net contributions are relative, therefore, rather than absolute. No items with negative betas are used in the final test selections.

The betas correspond to the p's, the betas squared correspond to the d's of Wright's path coefficient system: Sewell Wright, "Correlation and Causation," *Journal of Agricultural Research*, 20:562, (Jan., 1921); Harold E. Abelson, *The Art of Educational Research*. (Yonkers-on-Hudson, N. Y.: 1933.) Pp. 253-275.

The net contribution of each item to the balanced and weighted 30-item criterion (Motor Fitness Inventory) is determined by using all fourteen items in a fifteen variable multiple regression analysis for the betas. The betas (B's) correspond to the weighting coefficients in the standard score regression equation: (Z's are in standard scores) $Z_0 = B_1 Z_1 + B_2 Z_2 + B_3 Z_3 + B_4 Z_4 \ldots$ BnZn. The net contribution of each item to the criterion is in proportion to the betas squared. If there were no sampling or measurement errors, the sum of all the B's squared would equal 1 in this analysis of the net contributions of the various items to the whole criterion. Thus, in this problem the sum of the B^2's equals .8866. We may summarily say that the total variance accounted for is 88.66% and the sampling and measurement errors and unmeasured variance amount to a total of 11.34%.

The multiple R for combining the entire 14 items to predict the 30-item criterion is .934. This shows that the 14-item test has high predictive value and is valuable as a measuring instrument for predicting all-round performance. It will predict the 1000-point score criterion of the 30-item battery to an efficiency of 167 points for the standard error of prediction equivalent to 5.96 per cent of the 1000-point scale.

EFFICIENCY OF VARIOUS COMBINATIONS TO PREDICT ALL-ROUND ABILITY

By combining the items progressively according to multiple regression procedure the efficiency of prediction may be determined by calculating the multiple R for each combination. These are shown for progressive combinations of all the items in the 14-item test (the efficiency of an item may be judged by the amount it raises the multiple R; in terms of percentage the efficiency is proportional to R^2).

TABLE IV

MULTIPLE R'S FOR VARIOUS COMBINATIONS OF TEST ITEMS

For various combinations of test items, the multiple R's showing the relative efficiency of prediction are as follows:
(Notation corresponds to that used in TABLE I)

	**	*
R0.8-9	.60	.55
(Combining Medicine Ball Put, Dive, and Roll)		
R0.8-9-11	.72	.69
(Combining Bar Vault with the above two items)		
R0.8-9-11-12	.81	.74
(Combining Chinning with the above three items)		
R0.7-8-9-11-12	.86	.76
(Combining Leg-Lifts and Sit-Ups with the above four items)		
R0.7-8-9-10-11-12	.90	.78
(Combining Breath Holding After Run with the above five items)		

* These are the betas obtained from separate solutions for each combination of items. These values are slightly low because of attenuation in the basic measurements and due to the expected shrinkage in the multiple R because so many items (see S. C. Larson, "The Shrinkage of the Coefficient of Multiple Correlation," *Jour. of Ed. Psych.*, 22:45-55, Jan., 1931).

** These values are probably spuriously high because the betas used are from the final 14-item solution. As to the R reaching a maximum, E. E. Cureton states, "It is a not too well known fact that when unreliable tests are combined into a battery for the prediction of a criterion, there is an optimum number. Beyond this number the addition of tests to the battery reduces its reliability more than it increases its validity and the multiple correlation drops. This effect is greatly exaggerated when the criterion contains all or any of the prediction tests." The betas in this solution are from the entire 14-item solution, which assumes perfect reliability. Since there is not perfect reliability the R's reach a maximum value and then become lower as more than eleven variables are combined. The true values of the R's are higher than those in the right column and lower than those in the left column of Table IV.

R0.6-7-8-9-10-11-12	.93	.78
(Combining Man-Lift and Let-Down with the above six items)		
R0.3-6-7-8-9-10-11-12	.93	.78
(Combining Trunk Extension with the above seven items)		
R0.3-5-6-7-8-9-10-11-12	.93	.78
(Combining Extension Press-Up with above eight items)		
R0.3-5-6-7-8-9-10-11-12-14	.91	.83
(Adding Mile Run to the above nine items)		
R0.2-3-5-6-7-8-9-10-11-12-14	.88	.84
(Adding Squat Stand to the above ten items)		

SOME OTHER POSSIBLE COMBINATIONS

Several other combinations of the items are possible and the efficiency of these for predicting the criterion are as follows:

R0.7-12-14 = .58 (Combining Leg-Lifts and Sit-Ups with Chinning and Mile Run)

R0.7-12-13-14 = .59 (Combining Leg-Lifts and Sit-Ups, Chinning, Standing Broad Jump, and Mile Run)

R0.7-8-10-12 = .63 (Combining Leg-Lifts and Sit-Ups, Medicine Ball Put, Breath Holding After 2-Min. Run, Chinning)

R0.2-3-9-12-13-14 = .71 (Combining Squat Stand, Trunk Extension, Dive and Roll, Chinning, Standing Broad Jump, and Mile Run)

R0.2-7-8-9-12-14 = .80 (Combining Squat Stand, Leg-Lifts and Sit-Ups, Medicine Ball Put, Dive and Roll Agility, Chinning, Mile Run)

R0.8, 9, 10, 00, 12, 14 = .81 (Combining Medicine Ball Put, Dive and Roll, Breath-Holding After Run, Bar Vault, Chinning, Mile Run)

R0.7-8-9-10-11-12-14 = .81 (Combining Leg-Lifts and Sit-Ups, Medicine Ball, Put, Dive and Roll, Breath Holding After Run, Bar Vault, Chinning, Mile Run)

The last three combinations give slightly higher multiple *R*'s than the 7-item combination selected. However, all three of these include the Mile Run, which is not possible in the winter in many gymnasiums without running tracks. The mile takes a great deal of time, almost as much as the rest of the test. The 7-item test selected has a multiple *R* of .78 which is not much lower than .80, .81, .82. If the principal idea is to save time, then the mile may be omitted without serious loss.

CONCLUSIONS

1. Based on the pass or fail data for 171 college men the relative net worth of the 14-items studied to predict the 30-item criterion of balance, flexibility, agility, strength, power, and endurance items is as follows: Dive and Roll (agility), Medicine Ball Put (power), Bar Vault (agility), Chinning (endurance of arm and shoulder muscles), Leg-Lifts and Sit-Ups (endurance of thigh flexor and abdominal muscles), Breath Holding After Run in Place (circulatory-respiratory endurance), Man-Lift (lifting strength).

2. The items are not "pure" because some are intercorrelated with each other. Foot and Toe Balance correlates .53 with Medicine Ball Put, presumably because of balance common to both. The Squat-

Stand Balance correlates .59 with Man-Lift and .52 with Bar Vault, possibly because strength and balance are common. Trunk Extension Flexibility correlates .40 with Man-Lift, possibly because strength of the Back Extensor and Tensor Fascia Latae Muscles is common; and correlates .35 with Breath Holding After the Run in Place, possibly because chest flexibility is common. Trunk Flexion correlates .58 with Man-Lift perhaps due to the strength of the Tensor Fascia Latae, Thigh Flexor and Abdominal muscles acting in both. The Extension Press-Up correlates .47 with Bar Vault Agility due to the depressor shoulder muscles being vigorously used in both; also, it correlates .39 with Leg-Lifts due to the thigh flexor muscles being used in similar manner. The Man-Lift correlates .30 with the Standing Broad Jump due to the back and leg extensor muscles being vigorously used in both. Leg-Lifts and Sit-Ups correlate .46 with the Standing Broad Jump and .45 with the Mile Run, suggesting the involvement of the thigh flexor and tensor fascia latae muscles in jumping and running.

3. Striking uniqueness (independence) is seen in the intercorrelations where there are so many near zero or slight negative relationships. For instance, Medicine Ball Put correlates nearly zero with Dive and Roll (agility), Breath Holding After 2′ Run in Place (circulatory-respiratory endurance), Bar Vault (agility), Chinning (arm and shoulder flexion strength), Standing Broad Jump (.22) and Mile Run (C-R endurance). Foot and Toe Balance and Squat Stand Balance correlate very low with everything except other items which require high amounts of kinesthetic control, as do the agility, shot put events, and man-lifting events. The flexibility events are shown to be somewhat common with strength but are correlated very low with everything else. Even the strength events are highly specific to the type of acts in which they are involved. Agility events are poorly correlated with endurance items and strength items except where balance (kinesthetic sense) is involved, as in the Bar Vault and Squat Stand items.

4. A simple test of two, three, or four items is not possible without losing a great deal of what is wanted in a motor fitness test. Even the 7-item Short Test recommended as the outcome of this study is not as valid or as reliable as the 14-item test from which it was reduced. The weighted composite score of the short 7-item test correlates .61 with the composite score on the 14-item test. This is a direct practical test of validity. The theoretical validity judged by the multiple R is .78.

5. The items in the 7-item test may be weighted in proportion to the relative net contribution to the criterion, i.e., in terms of points

proportional to B^2's, since the pass and fail results do not yield the standard deviations of each item:

Items	*B's*	*B^2's*	*Proportionate Points*
Dive and Roll	.444	.197	27.5
Medicine Ball Put	.385	.148	20.7
Bar Vault	.355	.126	17.6
Chinning	.320	.102	14.3
Leg-Lifts and Sit-Ups	.236	.058	8.1
Breath Holding	.209	.044	6.1
Man Lift	.202	.041	5.7
		.716	100.0

6. The new Short Motor Fitness Test (7-items) is a better test than the combination of the six items (the best from each category of balance, flexibility, agility, strength, power, and endurance) recommended[6] in Jan., 1943. This 1943 short test was empirically selected on the basis of the highest zero order criterion in each group without respect to overlapping. The six events were Frog Stand (balance), Trunk Extension (flexibility), Dive and Roll (agility), Extension Press-Up (strength), Medicine Ball Put (power), and Chinning (endurance). The multiple R for this combination is .672. Then the improvement in predictive efficiency of the new 7-item combination is 34.5 per cent better than the 6-item test mentioned, using R^2 as a measure of efficiency.

7. The 7-item Short Motor Fitness Test can be administered in about 30 minutes with one instructor handling ten men in a squad. The pass or fail plan saves at least half of the time that would ordinarily be used to score each item on a continuous scoring basis as this requires putting the vault bar up and down, measuring each dive and roll, etc. Also, the plan of "screening out" the poorer subjects in ability is more safely and happily achieved when maximum performances are not called for but moderate standards used. The test is not such a severe test for most under this plan and is more defensible at the start of the year when large numbers of untrained men are tested.

8. Substitution of the Agility Run for the Dive and Roll item is recommended except when preliminary practice is possible under an experienced instructor to permit the rolls to be done (1) standing (2) over one or two feet (3) over 5 feet. Some slight loss in predictive value occurs with this substitution.

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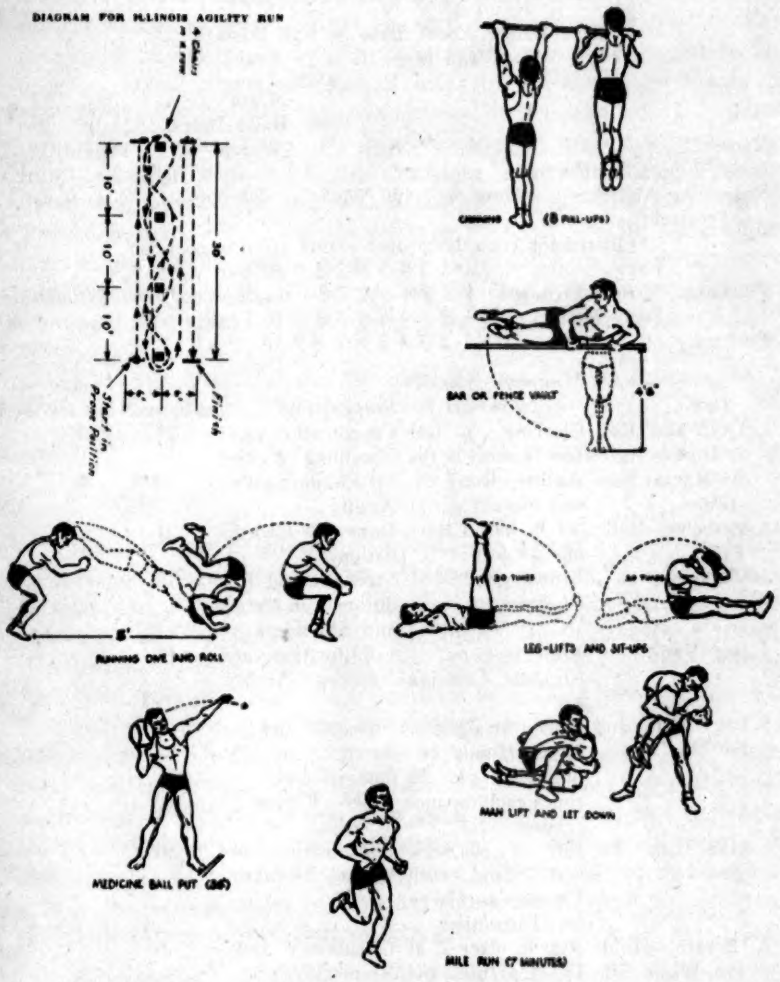
6 Cureton, "A Criterion for Motor Fitness," p. 13.



SHORT (7-ITEM) CLASSIFICATION TEST FOR MOTOR FITNESS

9. The 14-item test is undoubtedly better for obtaining a sample of performance in all of the areas of balance, flexibility, agility, strength, power, and endurance. The 14-item test permits more interesting events, a greater variety and allows a better diagnosis of ability in the fundamental motor traits.

10. Many other types of tests are possible with various other combinations of items. Therefore, this test is only one possible test for which the logic and research are presented. Undoubtedly, many other tests will be reported.

A SHORT CLASSIFICATION TEST FOR MOTOR FITNESS

(Indoor Form, Pass or Fail Basis)
Boys and Men 15 to 25 Years

Date .....
Body Build Index .....
Name ..... Age ..... Weight ..... Height .....
Body Type Classification ..... Body Type No. .....
Swimming Ability: None 100 Yds. 440 Yds. Life Saver
(encircle)

(Instructor encircles proper rating after inspection)

Fat: 1 2 3 4 5 6 7 8 9 10 Fat
Physique: Muscle Firmness: 1 2 3 4 5 6 7 8 9 10 Muscle Firmness and Size
Bony Mass: 1 2 3 4 5 6 7 8 9 10 Frailty and Linearity of
Posture 1 2 3 4 5 6 7 8 9 10 Skeleton

Item	*Minimum Standard to Pass*	*Emphasis*	*Points Allowed*	*Points Earned*	√ *or X*
1. Dive and Roll or Illinois Agility Run as Substitute	Clearing 5 feet (or 18 secs. in the Agility Run)	Coordination and Tumbling Agility or Running Agility	28		
2. Medicine Ball Put	6-7 lb. ball, Clearing 34 feet	Power & Coordination	21		
3. Chinning	Either grip, 10 times	Strength and Endurance in Arms and Shoulders	18		
4. Bar Vault	Both feet or Straddle, Clearing 4'6"	Coordination and Vaulting Agility	18		
5. Leg Lifts and Sit-Ups	Knees Straightened & Hands behind Neck, 20 times each, in succession	Strength and Endurance in Abdominal and Thigh Flexor Muscles	8		
6. Man Lift for Speed	Lift in 10 secs. and Stand with Fireman's Carry for Inspection	Coordination and Lifting Strength	6		
7. *Breath Holding While Sitting After 2' Run or the Mile Run in 7 Min.	Run in place 2' at 180 steps/min. and hold breath for 30 secs. with hand up	Circulatory and Respiratory Endurance	6		

√ = Pass
X = Fail

Total Raw Score....100
Examiner .....
Percentile Rating: .....
Comments .....
Standard Score: .....

*** On rainy days or in winter, this even may be used as a substitute for the mile run, although the mile is the preferred event. A good deal of the kind of condition needed to run the mile is already in Leg-Lifts and Sit-Ups (.45), Bar Vault Agility (.37), and Chinning (.27). The intercorrelations are shown in parenthesis. This explains the low weights assigned to the mile.**

It is helpful to obtain information about the identification of the subject including name, height, weight, age, body type classification, swimming ability, and physique as judged by inspection and feeling the contracted biceps, abdominal and thigh muscles, and also by pinching up the fat and skin over the abdomen and waist. Separate ratings on a scale of ten may be given for fat, muscle firmness, and fragility of bony mass. If the examiner is experienced he can estimate the somatotype numbers according to the Sheldon, Stevens, Tucker system. [7, 8, 9] This is perhaps the best way to differentiate individuals quickly with respect to differences in the quality and quantity of the tissues. This makes the test a little more complete and gives results useful in sectioning men for physical education.

The body-build index is the ponderal index or its reciprocal. The latter fits in with the Sheldon scheme, namely,

$$\text{Body Build Index} = \frac{\text{Height (inches}}{\sqrt[3]{\text{Weight (lbs.)}}}$$

Interest may be stimulated by placing the subjects in two lines facing each other. Partners record for each other the fat, muscle, skeletal, and posture ratings as they are given by the instructor. The instructor will fill in the body-build index, the body-type classification and the body-type number from the age, height, weight, and inspectional ratings. This may be done at a later time at his convenience, or these items may be omitted. In rating fat each man is roughly tested by pinching up the fat on the abdomen, hips, glutei, arms and legs, then rated (fat tables are in the *Physical Fitness Workbook*.[10]) In rating the muscles it helps to feel the contracted biceps and abdominal muscles, the latter by pushing a fist into the abdomen against the subject's resistance. At the end of the test each man is lined up in order of his total score from "most fit" to "least fit." This causes a good deal of interest.

Description of Events.—All events except the last one are described in the *Physical Fitness Workbook*.[11] The breath-holding event after run should be demonstrated as to the method of running with each foot lifted at least 4″ high, only one long breath taken after

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7 W. H. Sheldon, S. S. Stevens, and W. B. Tucker. *The Varieties of Human Physique.* (New York: Harper and Bros., 1940.) Pp. 347.

8 T. K. Cureton, and Paul Hunsicker, "Body Build as a Framework of Reference for Interpreting Physical Fitness and Athletic Performance, *Supplement to the Research Quarterly*, 12:301-330 (May, 1941).

9 A guide and simplified pattern for making the physique judgments is given in the *Physical Fitness Workbook*, pp. 103-106. Refer to Reference No. 4.

10 Cureton, *Physical Fitness Workbook*, p. 132.

11 *Ibid.*, pp. 19-27.

stopping the run and the method of holding up the hand as long as the breath is being held. An instructor should actually set the pace in this running. Each pupil copies the instructor's style and keeps in step with him. A large stop clock on the wall or on the floor in front of the instructor will permit him to see the time and give the starting and stopping signals for the running and the breath holding.

In the Dive and Roll it is important to start this event from a stand and perform the first trial without a dive or run, just executing a forward roll from a standing position. Those who cannot do this with good body control are immediately eliminated and marked X. Those who pass this are allowed a second trial from a walk, covering not more than three feet. Those failing are eliminated. Then the remaining ones try the run and dive over the full five feet. This procedure has eliminated accidents.

In the Man-Lift the emphasis is upon strength to lift and control the subject at all times. Losing the balance, falling and dropping the subject after the lift count as failures just as much as inability to lift the subject. One demonstration is usually necessary for this event before any try it. Partners should be matched as nearly as possible in weight.

Near passes can be credited a few points below the regular points allowed, at the discretion of the instructor. Partners may work together and score each other under the close supervision of an instructor.

NORMATIVE STANDARDS

Based on 459 cases of young men entering the University of Illinois in the fall of 1943, the following normative standards have been arranged for the 7-item Short Classification Test for Motor Fitness. The points on the test may be encircled (raw score). The other types of scores are directly opposite.

Raw Score	*Standard Score*	*T-Score*	*Percentile Score*
100	100	80	100
96	80	68	90
93	64	58	80
90	58	54	70
87	54	52	60
82	50	50	50
77	47	49	40
65	37	43	20
58	28	37	10

Likewise, the norms have been prepared for the Agility Run, used as a substitute for Dive and Roll Agility.

RATING SCALE FOR ILLINOIS AGILITY RUN

Percentile Score	*Time (Sec.)*	*T-Score*	*Standard Score*
99.9999	14.0	98.45	
99.999	14.5	94.57	
99.997	15.0	90.70	
99.989	15.5	86.62	
99.952	16.0	82.94	
99.81	16.5	79.06	100
99.38	17.0	75.19	90
98.42	17.5	71.32	85
95.99	18.0	67.44	78
91.15	18.5	63.57	72
82.89	19.0	59.69	66
72.57	19.5	55.21	60
57.93	20.0	51.94	53
42.07	20.5	48.08	47
27.43	21.0	44.19	40
17.11	21.5	40.31	34
8.85	22.0	36.43	27
4.01	22.5	32.56	22
1.58	23.0	28.68	14
.62	23.5	24.81	7
.29	24.0	20.94	4
.05	24.5	17.06	1
.01	25.0	13.18	0

Survey of the Requirement and Credit in Physical Education in Colleges and Universities as of Fall Term, 1944

By

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(*Submitted for publication, March,* 1945)

TWO of the measures of progress for the field of physical education are the time given for physical education in the school curriculum and the amount of credit given for accomplishment in courses in physical education. While the final test of the worth of a program is its quality and subsequent influence, an increase in the recognition given to the program is a practical index of its value and can in turn make possible a finer end result. This survey has been made on the requirement and credit in physical education in colleges and universities as of the fall term, 1944.[1] Its threefold purpose is:

1. To determine the status of the requirement and credit in physical education.

2. To investigate the effect of the war on the requirement and credit in physical education.

3. To find out whether the changes made may become permanent.

Two studies have been done on the subject in the past five years. The first[2] was based on 57 replies from men's physical education divisions in land grant colleges and universities and indicated not only a definite increase in time allotment and hours per week of class meetings, but also a considerable change in the content of the program. The second[3] sampled twenty important eastern and midwestern colleges and universities. An increase in the number of meetings per week of classes was reported and some indication given that the requirement would be increased further after the war.

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1 The survey was done under the sponsorship of the Department of Physical Education at the University of California at Los Angeles, Dr. John Bovard gave generous assistance throughout the progress of the study.

2 Lloyd M. Jones, "Recent Changes in the Requirement and Content of Required Health and Physical Education for Men in Land Grant Colleges and Universities," *Research Quarterly,* 13:3 (October, 1942), pp. 364-72.

3 Randolph Webster, "A Survey of Physical Education Requirements for Graduation," *Journal of Health and Physical Education,* 16:4 (April, 1945), pp. 174, 214-218.

METHOD

A total of 221 questionnaires accompanied by a letter of explanation was sent out December 17, 1944, to a sampling of (1) coeducational state universities and colleges, (2) private coeducational schools, and (3) private men's and women's colleges. Separate questionnaires were sent to men's and women's departments of the same school. A total of 168 replies from 107 different schools was received by February 1, 1945.

Frequency distributions were tabulated for each question in two ways: (1) according to locality as determined by the six regional divisions of the American Association for Health, Physical Education, and Recreation, and (2) according to the type of school as indicated above by the classification of the sampling. The distribution of schools according to enrollment in women's divisions of coeducational state universities and colleges is shown but is not used in the final results of the study since such analysis did not prove to be significant.

RESULTS

The results for each question in the survey are given and in table form where it might be helpful.

1. Analysis of Replies

TABLE I

Regional

	East	*Central*	*Mid-west*	*South*	*North-west*	*South-west*	*Total*
Number sent out	49	32	40	56	16	28	221
Number returned	36	25	33	36	15	23	168
Per cent returned	75%	78%	83%	64%	94%	82%	76%

TABLE II

Type of School

	State Coeducational		*Private Coeducational*		*Private*	
	Men	*Women*	*Men*	*Women*	*Men*	*Women*
Number sent out	67	69	26	26	11	22
Number returned	51	52	22	21	6	16
Per cent returned	77%	75%	84%	81%	55%	73%

An analysis of the replies shows that the best regional response came from the northwest and middlewest and the poorest from the south. The highest percentage of response from types of schools came from the private coeducational schools for both men and women and the poorest from the men's private schools, which, however, was the smallest group considered.

TABLE III

DISTRIBUTION OF ENROLLMENT OF WOMEN'S DEPARTMENTS IN STATE SCHOOLS BY REGIONS

	East	*Central*	*Midwest*	*South*	*North-west*	*South-west*	*Total*
1-500	2	2	2	5	2	1	14
500-1000	1	6	3	2	2	1	15
1000-1500	0	2	0	0	2	0	4
1500-2000	0	2	1	4	1	1	9
2000-over	0	1	5	0	0	3	9
						No reply	1
							52

The distribution in enrollment appears to be fairly even throughout the districts. Women's divisions were used since the enrollment in men's departments is not representative due to the war.

2. UNDER WHAT CALENDAR SYSTEM DO YOU OPERATE?

Two semester	64	38%
Three term	72	43%
Four quarter	32	19%

The distributions were fairly even regionally with the east and midwest having the highest percentage on the two-semester plan, the central and southwest on the three-term system, and the south on the four-quarter calendar. The same is true when the distribution for types of schools is analyzed except that 69 per cent of the private women's schools are on the two-semester plan and 60 per cent of the coeducational private schools are on the three-semester system.

3. REQUIRED PHYSICAL EDUCATION

A. *Do you require physical education for graduation?*

Yes	161	96%
No	7	4%

There was no significant distribution of the "no" replies by region or by type of school.

B. *How often do required courses meet weekly?*

Two	43	26%
Three	75	45%
Four	8	5%
Five	12	7%

Twenty-one or 12 per cent required a difference of times in different years, averaging two and one-half times weekly, the most frequent variation being three times in the freshman year and two times in the sophomore year. Nine or 5 per cent did not reply.

TABLE IV

REGIONAL DISTRIBUTION OF NUMBER OF TIMES REQUIRED COURSES MEET WEEKLY

	East	*Central*	*Midwest*	*South*	*North-west*	*South-west*	*Total*
Two	10	4	13	7	4	5	43
Three	13	12	13	20	8	9	75
Four	4	1	1	0	2	0	8
Five	2	3	0	3	0	4	12
							138

TABLE V

DISTRIBUTION BY TYPE OF SCHOOL OF TIMES REQUIRED COURSES MEET WEEKLY

	State Coeducational		*Private Coeducational*		*Private*		
	Men	*Women*	*Men*	*Women*	*Men*	*Women*	*Total*
Two	13	16	4	6	4	0	43
Three	25	25	9	7	5	4	75
Four	3	2	2	0	0	1	8
Five	4	1	5	2	0	0	12
							138

C. Can physical education be elected?

Yes	129	76%
No	16	10%
No reply	23	14%

The distribution of negative replies was even according to region and type of schools except that seven negative answers came from the south. Several schools who replied "no" mentioned that lack of facilities precluded elective work or that physical education was required for all students for four years and thus was not elective. Ten schools added that no credit is given for elective work.

D. What is the length of the time requirement for physical education?

One year	13	8%
Two years	78	46%
Three years	8	5%
Four years	55	33%

Three cases did not answer and there were four variations three of which had a requirement of over two years making 36 per cent in all who have a requirement over two years. Seven cases reported no requirement.

TABLE VI

REGIONAL DISTRIBUTION OF TIME REQUIREMENT

	East	*Central*	*Midwest*	*South*	*North-west*	*South-west*	*Total*
One year	2	4	2	3	1	1	13
Two years	14	13	13	21	8	9	78
Three years	2	1	0	2	3	0	8
Four years	17	4	13	7	3	11	55
Variation	1	1	1	1	0	0	4
No answer	0	1	2	0	0	0	3
No requirement	0	1	2	2	0	2	7
							168

TABLE VII

DISTRIBUTION BY SCHOOL OF TIME REQUIREMENT

	State Coeducational		*Private Coeducational*		*Private*		
	Men	*Women*	*Men*	*Women*	*Men*	*Women*	*Total*
One year	7	4	0	1	1	0	13
Two years	22	32	7	8	0	9	78
Three years	1	2	0	2	1	2	8
Four years	17	7	14	8	4	5	55
Variation	1	2	0	1	0	0	4
No answer	1	2	0	0	0	0	3
No requirement	2	3	1	1	0	0	7
							168

The east and midwest had the greatest number of institutions with a four-year requirement and men's departments have a higher proportion of four-year requirements than women's.

The explanation for the greater prevalence of the four-year requirement among men's divisions may be the strong demand of the Army and Navy for increased physical education in college programs for men. This matter is discussed in detail by Jones.[4]

4. CREDIT FOR PHYSICAL EDUCATION

A. Is credit given toward graduation for physical education work?

Give credit	138	82%
No credit	28	17%
No answer	2	1%

TABLE VIII

PER CENT OF AFFIRMATIVE REPLIES BY REGION

East	*Central*	*Midwest*	*South*	*Northwest*	*Southwest*
75%	84%	79%	81%	100%	96%

[4] Jones, *op. cit.*, *pp.* 364-65.

TABLE IX

PER CENT OF AFFIRMATIVE REPLIES BY TYPE OF SCHOOL

State Coeducational		*Private Coeducational*		*Private*	
Men	*Women*	*Men*	*Women*	*Men*	*Women*
90%	85%	73%	87%	57%	84%

The distribution is in favor of state schools and women's divisions as opposed to men's private and men's divisions in coeducational schools.

B. How much credit is given per semester (quarter or term) for physical education?

On the basis of the 82 per cent who replied that credit is given, the following results obtained:

TABLE X

AMOUNT OF CREDIT BY REGIONS

	East	*Central*	*Midwest*	*South*	*Northwest*	*Southwest*	*Total*
½ unit	4	1	0	2	1	5	13
1 unit	16	17	22	18	16	15	104
Variations	0	2	1	5	0	2	10
No reply	6	1	1	3	0	0	11
							138

TABLE XI

AMOUNT OF CREDIT BY TYPE OF SCHOOL

	State Coeducational		*Private Coeducational*		*Private*		
	Men	*Women*	*Men*	*Women*	*Men*	*Women*	*Total*
½ unit	3	5	1	1	0	3	13
1 unit	43	35	10	10	2	4	104
Variations	0	2	1	5	0	2	10
No reply	6	1	1	3	0	0	11
							138

These figures indicate that the large majority of schools give one unit credit per semester, quarter, or term for required physical education.

C. How much credit toward graduation is allowed?

Considerably less standardization exists on this point than on the previous one. In Table XII one division has been made for the four-semester and six-quarter groups, a second for the six-semester and nine-quarter groups, and a third for the eight-semester or twelve-quarter goups on the basis that two semester or term units are equal to three quarter units.

TABLE XII

AMOUNT OF CREDIT TOWARD GRADUATION BY REGIONS

	East	*Central*	*Midwest*	*South*	*North west*	*South west*	*Total*
4 semesters (6 quarters)	9	8	6	11	3	10	47
6 semesters (9 quarters)	3	7	0	4	8	3	25
8 semesters (12 quarters)	3	2	9	4	1	5	24
Variations	3	2	3	5	3	4	20
Unlimited	2	0	3	2	1	0	8
No reply	6	2	3	2	1	0	14
							138

TABLE XIII

AMOUNT OF CREDIT TOWARD GRADUATION BY TYPE OF SCHOOL

	State Coeducational		*Private Coeducational*		*Private*		
	Men	*Women*	*Men*	*Women*	*Men*	*Women*	*Total*
4 semesters (6 quarters)	19	14	7	5	0	2	47
6 semesters (9 quarters)	9	12	1	2	0	1	25
8 semesters (12 quarters)	9	8	4	2	1	0	24
Variations	8	3	1	2	2	4	20
Unlimited	3	4	0	0	0	1	8
No reply	0	4	2	6	0	2	14
							138

D. Is credit for physical education the same as that given for academic work?

Yes	95	69%
No	23	17%
No reply	14	10%
Variations	6	4%

5. CHANGES

A. Has your requirement in physical education changed since 1940?

Yes	98	58%
No	70	42%

Sixty-one either instituted a requirement for the first time or increased it, 31 increased the number of times classes meet weekly, 11 gave credit for the first time or increased the credit, 9 reported program changes, and 8 have changed back to a prewar program. Many of the schools made more than one change, a typical one be-

ing from two to four times weekly and from two to four years required.

A further analysis of the cases of instituting or increasing the time requirement showed that 42 of the 61 were shifts to the four-year requirement for the first time, indicating that only 13 out of the 55 who now have a four-year requirement had it before the war. Six of the schools are requiring physical education for the first time and the other thirteen institutions increased the requirement by one or two years. An analysis of the shifts to the four-year requirement are shown as follows:

East	*Central*	*Midwest*	*South*	*Northwest*	*Southwest*	*Total*
12	6	11	9	3	1	42

State Coeducational		*Private Coeducational*		*Private*		
Men	*Women*	*Men*	*Women*	*Men*	*Women*	*Total*
20	6	9	3	3	1	42

B. Does your institution plan to return to a prewar program of physical education at the end of the war?

Yes	25	15%
No	55	33%
Undecided	63	37%
No reply	25	15%

The lack of reply in this case might well indicate indecision. The distribution of the answers was even according to region and according to type of schools.

SUMMARY

On the basis of 168 replies distributed regionally and according to type of schools the following conclusions are drawn:

1. Physical education is required for graduation in nearly all (96%) of the schools who replied. Classes meet most generally three times weekly followed in frequency by two, five, and four times weekly. Nearly half the group have a two-year requirement and one-third a four-year requirement. Physical education classwork may be elected for credit in three-fourths of the schools.

2. Credit is given for physical education in over three-fourths of the schools, the most frequent type being one unit per semester, term, or quarter. In the majority of cases the credit is the same as that given for academic work.

3. Changes in the requirement have been made by 58 per cent of the schools since the war, the most frequent type of change being in the time requirement. The majority of these changes are in men's departments.

4. Few schools have returned as yet to a prewar program and only 15 per cent indicate a decisive intention to so return; the rest are undecided or do not intend to change back.

Validation of Mass-Type Physical Tests with Tests of Work Capacity

By

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(Submitted for publication, April, 1945)

DURING the past few years the attention of physical educators has been directed especially toward the development of physical fitness in the youth of our nation. One of our chief problems has been the measurement of fitness.

Most of our fitness programs have employed the procedure of subjecting the students to physical activity of graded intensity for the purpose of improving their work capacity. The soundness of this practice cannot be questioned since it is based upon the physiological principle that capacity to do work is increased by performing more and more work. It might be assumed, therefore, that persons engaged in such a rigorous program of exercise do improve in their ability to meet the physical demands made on them. Ample evidence of this fact is available through the results of military conditioning programs.

Many types of tests have been devised to measure physical fitness. The medical examination has long provided us with a measure of static fitness. Physical educators are interested also in the dynamic physical fitness of the individual or his capacity for muscular effort. Various types of tests have been devised to measure this dynamic physical fitness. Most of these have been performance tests or tests of improvement in certain factors which are certainly component parts of the total picture. These have included items designed to measure strength of certain muscle groups, agility, endurance, skill, and speed. The results of these tests have been largely qualitative and comparative; they have demonstrated improvement over previous scores established by the individual, or have established standards of performance in relationship to group performances. Their relationship to the individual's capacity to do work is still unknown.

Another type of test has been widely used to establish functional

fitness of the individual. These have measured cardiovascular responses and respiratory reactions to work.

An actual measure of work capacity is quantitative, or is measured in physical units of work. In a recent report Tuttle and Wendler[11] * describe a means of measuring work capacity. They say, "Since dynamic physical fitness may be defined as capacity to do work, the ergometer provides reliable and valid criteria of this type of fitness. Studies made seem to indicate that maximum total work output for a period of two minutes is in itself a valid criterion of dynamic physical fitness."

The value of performance tests as measures of improvement and as motivating factors in the program is undeniable. However, it would be interesting to know what relationship exists between such tests and an individual's capacity to do work. If a significantly high relationship were found, then these mass-type tests, which are administratively more advantageous than testing with the ergometer, could be said to measure dynamic physical fitness or work capacity with a reasonable degree of accuracy.

This study involves such a comparison, that is, a comparison of two types of mass physical fitness tests with the capacity to do work as measured in kilogram-meters for a two-minute period by a bicycle ergometer.

STATEMENT OF THE PROBLEM

The purpose of this study is four-fold:

1. To determine the relationship between single test items in the Iowa Physical Fitness Battery[7] and the work capacity of the individual.
2. To determine whether this battery, or some combination of items in the battery, has a sufficiently high relationship with work capacity so that such a mass testing procedure could be said to measure the fitness of individuals.
3. To determine the relationship between the Clarke-Brouha Functional Physical Fitness Test for College Women[2] and the capacity to do work, as well as the relationship between the Clarke test and the Iowa tests.
4. To determine the specific contribution of the bounce test.

Work capacity is defined in this study as the total work output of the individual as measured in kilogram-meters for a two-minute period at maximum speed on the bicycle ergometer.

* Superior figures refer to numbered bibliography at end of article.

PROCEDURE

The subjects for this investigation were undergraduate women students at the University of Iowa. All of the subjects were medically sound and all were taking three or more hours of physical education per week. The subjects were selected by the staff of the department of physical education for women with the intention of securing a group with a wide range in motor ability. Eighty-two subjects completed the Iowa tests and the test on the bicycle ergometer. Twenty-five subjects also completed the Clarke-Brouha test.

All subjects were questioned as to bicycle-riding experience. Only four of the group stated that they did not know how to ride a bicycle. Most of the group stated that they rode a bicycle at the present time infrequently or not at all. Only four stated that they rode frequently.

In establishing the criterion of capacity to do work, each subject was required to ride the bicycle ergometer at her maximum speed for a period of two minutes. The resistance on the ergometer was three amperes; the recordings were in voltage for each 5-second interval. Work capacity was then computed in kilogram-meters for the two minutes. A conversion table developed by Tuttle and Wendler was used for this purpose.[11] A previous study had established this as the most satisfactory method for measuring the work capacity of college women.[6] A description of this equipment and of the method of computation is provided by Wendler and Tuttle.[11]

The Iowa Physical Fitness Battery is composed of test items developed by Mohr,[7] Scott,[10] and Wilson[12] and includes sit-ups, chair-stepping, vertical pull, obstacle run, and bounce. The reliability coefficients as established in Mohr's study were: sit-ups, .936; chair stepping, .946; pull, .932; obstacle, .910; and bounce, .787.

The subjects for this investigation were tested in the routine testing of all freshman and sophomore students at the end of the first semester, 1944. The administration of this battery is recorded elsewhere in the literature.[7] Slight variations have been made in the form and scoring of two of the tests since the previous report. These are described in the appendix.

The functional test used was Clarke's[2] adaptation of the Brouha test.

All three of these tests were administered within a period of ten days. No two tests were given the same day.

DISCUSSION OF DATA

Zero-order correlations of the test items in the Iowa Physical Fitness Battery were computed with the criterion (work capacity) and follow in rank order.

1.	Obstacle run	.529
2.	Vertical pull	.486
3.	Total Sit-up (50 sec.)	.482
4.	Bounce	.448
5.	Total Chair Stepping (45 sec.)	.402
6.	Total Chair Stepping (50 sec.)	.372
7.	Chair Stepping (ratio)	.372
8.	Sit-up (ratio)	.351

All of these correlations are significant for eighty-two cases at the one per cent level of confidence.[5] Thus it may be said that a definite relationship does exist between each of these items and the individual's capacity to do work.

Zero-order correlations were computed with the test of work capacity for a fifty-second period. This was done to see if the difference in the time period utilized in the bicycle test and that in the chair stepping and sit-up tests had any bearing upon the relationship. In all cases except the pull the coefficients were slightly lower than those with total work for the two-minute period. The fifty-second interval seemed to represent an initial spurt on the bicycle, rather than ability to maintain a work rate. This was evidenced by a study of performance on successive five-second intervals. Consequently these correlations are not recorded here. The maximum work rate achieved by the individual represents a single moment of effort and is indicated by the maximum voltage reading. This was correlated with each test item. Similarly, coefficients were lower except for pull and sit-up (ratio) and are not presented here. The higher correlation of the pull with both the fifty-second interval and the maximum work rate may be explained partially by the fact that all three measures represent only a momentary effort.

Intercorrelations were computed for the performance tests and are shown in Table I.

TABLE I

INTERCORRELATIONS OF PERFORMANCE TESTS

	1	2	3	4	5	6	7	8
1. Bounce		1.44	.371	.275	.396	.385	.425	.418
2. Pull			.300	.226	.147	.195	.112	.134
3. Obstacle				.239	.458	.512	.516	.503
4 Sit-up (ratio)*					.319			.401
5. Chair-Stepping (ratio)*						.322		
6. Total Sit-up (50 sec.)*							.475	.494
7. Total Chair Stepping (50 sec.)*								
8. Total Chair Stepping (45 sec.)*								

In attempting to establish a battery of tests from the performance tests, items showing highest validity with the criterion and lowest intercorrelations were used in combinations of two, three, four, and finally all five items. Multiple correlations were computed

* See appendix for explanation regarding scoring of these items.

by the Doolittle method.[8] These follow in descending rank order in Table II.

TABLE II

MULTIPLE CORRELATIONS OF PERFORMANCE TESTS WITH CAPACITY TO DO WORK

	R
Two-Item Combinations:	
1. Pull-Obstacle	.632
2. Pull-Bounce	.627
3. Pull-Total Sit-up (50 sec.)	.626
4. Pull-Total Chair Stepping (45 sec.)	.595
Three-Item Combinations:	
5. Pull-Bounce-Obstacle	.681
6. Pull-Bounce-Total Sit-up (50 sec.)	.674
7. Pull-Obstacle-Total Sit-up (50 sec.)	.672
8. Pull-Obstacle-Total Chair Stepping (45 sec.)	.655
9. Obstacle-Sit-up (50 sec.)-Chair Stepping (45 sec.)	.590
Four-Item Combinations:	
10. Pull-Obstacle-Bounce-Total Sit-up (50 sec.)	.703
11. Pull-Obstacle-Chair-Stepping (45 sec.)-Bounce	.687
12. Pull-Bounce-Chair Stepping (45 sec.)-Sit-up (50 sec.)	.684

The multiple correlation of all five items with capacity to do work was .695. In other words, the pull, obstacle race, bounce and either the sit-up (50 seconds), or the chair stepping (45 seconds) will give as adequate a measure of work capacity as all five items together. The advantage from the standpoint of administration of the tests, is in favor of the sit-ups. The sit-ups require less space and equipment and are more easily motivated for maximum effort. If time of administration is an important factor, and one is not interested in specific tests, batteries 5 or 6 might be used with almost as much assurance on the measurement of fitness in terms of work capacity. From the time standpoint No. 6 would be better since the sit-up test is a mass test and the obstacle race must be given individually.

The proper weighting for items in batteries 5, 6, 10, and 11 follow:

.1 bounce + .5 pull + 1.5 obstacle
1. bounce + 5. pull + .1 sit-up (50 sec.)
2. bounce + 12. pull + 26.5 obstacle + 1. sit-up (50 sec.)
.5 bounce + 2.5 pull + 6. obstacle + 1. chair stepping (45 sec.)

The relationship of the test items as shown by the intercorrelations is too high to give as comprehensive a measure of fitness as might be hoped from a composite battery. However, it does appear that the use of three or four items will give a reasonably satisfactory indication of capacity for work.

Zero-order correlations were computed for the Clarke Functional Physical Fitness Test and each of the other tests. These follow:

Total Work on ergometer	.082
Obstacle Run	.237
Pull	.180
Total Sit-up (50 sec.)	.205
Bounce	—.001
Chair Stepping (ratio)	—.188
Chair Stepping (50 sec.)	—.019
Chair Stepping (45 sec.)	—.153

TABLE III

CORRELATIONS BETWEEN WEIGHT AND HEIGHT AND FITNESS TESTS

	Weight	*Height*
Obstacle	—.203*	—.019
Pull	.344*†	.232*
Sit-up	—.015	—.195
Bounce	—.041	—.176
Chair stepping	—.071	—.084
Push-up	—.067	—.088
Bicycle ergometer**		

* For 100 cases the 5 per cent level of significance is .197 and the 1 per cent level is .256.

† On another random sample of 100 cases the r was only .255. Both are significant, however.

** Meerdink obtained an r of .150 between size (as indicated by surface area) and total work capacity on the bicycle ergometer. This is not significant for 65 cases, as used in her study.6

None of these shows a significant relationship for twenty-five cases.

Effect of Body Build on Performance.—It might be assumed that the fact of weight and length of body parts might affect the individual's ability to perform these tests. Therefore, correlations were computed between height and weight and each of the tests on a random sample of 100 sophomore women. These coefficients appear in Table III, and indicate that there is little or no relationship except with the pull test and possibly with the obstacle race.

This is doubtless explained by the fact that the larger the build, the larger the muscles and the greater the strength. Also the larger and overweight person is handicapped on the obstacle race in getting under the crossbar.

Validation of the Bounce Test.—The bounce test is a fairly new device developed at the University of Iowa in an effort to secure a test of foot and lower-leg strength. It is representative of the type of test which has been included in fitness batteries on an empirical and rational basis because the process of validation was not always feasible. An attempt has been made to determine the ability demonstrated in this test.

The bounce was analyzed for its probable components, namely, leg strength, endurance of lower leg and foot muscles, balance, perseverance (or persistence of effort after discomfort). For each component measures were selected. This procedure led to the following list of tests:

Leg strength—Leg lift (with belt),[3] ankle extension.[9]

Leg endurance—Rhythmic ankle extension for endurance.*

Balance—Bass balance test[1]; item No. 3 in Johnson motor educability test.[4]

Perseverance—Arm support on parallel bars.[12]

Since there seems to be some degree of relationship between strength of different muscle groups, other strength measures were taken. These include push and pull on a dynamometer with push-pull attachment, push-up on knees, vertical pull.[12]

Three forms of the bounce were given. The first was the standard form[7] with arms wrapped around the legs, hands holding shin of opposite leg. The second was done with knees immobilized by putting arms straight down outside of legs and hands holding front of ankles. In the third form the hands might be anywhere except in the two positions already used. A large percentage of the subjects left the hands resting lightly on top of the thighs.

The group studied consisted of sophomore women; 32 in a class for conditioning and 16 in a stunts and tumbling class completed all tests.

The three bounce tests were given on different days.

The reliability of each form of the bounce was determined by administration of the test at the beginning and at the end of the same class period. Coefficients of reliability were:

Bounce 1	.872
Bounce 2	.877
Bounce 3	.879

Reliability of Bass and Johnson tests computed on scores secured on successive days were .638 and .558 respectively. Since the sum of the two trials was used the Spearman-Brown formula was applied to correct the coefficients to the double score. The coefficients then

* Subjects stood facing a wall, an arm's distance from it. The finger tips of one hand were just touching the wall to prevent loss of balance. The subject was instructed to rise on the balls of the feet with heels as high as possible, then to lower the heels very slightly; the distance from the heels to the floor was checked at 3 to 4 inches depending upon the height at full ankle extension. A few practice trials were given to determine the range of motion permitted; then the subject was tested for endurance. The movement was done rhythmically with a continuous upward movement of one-second duration and a downward movement of one second. The knees were kept fully extended. The subject continued as long as possible.

were .78 and .72 respectively. These were too low to consider the measures as very satisfactory for criteria; nevertheless, correlations were computed with the bounce. Correlation of Bass and Johnson

TABLE IV

INTERCORRELATIONS OF BOUNCE AND SELECTED TEST ITEMS

	Bounce 1	*Bounce* 2	*Bounce* 3
Bounce 1		.774	.806
Bounce 2			.798
Leg lift	.303*	.302*	.284*
Ankle extension-strength	.170	.158	.115
Ankle extension-endurance	.500**	.590**	.628**
Bass	.225	.251	.303*
Johnson	.275	.221	.151
Arm support on parallel bars	.586**	.432**	.416**

* For 48 cases the 5 per cent level of significance is .284.
** For 48 cases the 1 per cent level is .368.[5]

yielded a coefficient of only .122 indicating that they are not measuring the same ability. It is perhaps partially explained by the fact that the Johnson test was too easy for this group, and partially by the fact that the Johnson battery is a test of motor educability.

Table IV indicates the coefficients found with the three forms of the bounce. It will be noted that the bounce tests are all closely related. This is in spite of the fact that in no case did the subjects report soreness after the tests except in the case of bounce No. 3. A large number reported soreness in the quadriceps extensor of the knee indicating that there was knee action in this test and not in the first two forms.

The bounces are most consistently high with endurance of ankle extensors. This is to be expected since they each represent repeated ankle extension. The correlations between the bounces and ankle extensor strength are low, though those between bounces and total leg strength are significant. No explanation is available for this difference. However, two factors which doubtless influence this are (1) the measurement of ankle extensor strength which is uncomfortable for the subject, (2) the adjustment of the apparatus so that the heel could be raised only very slightly from the platform; therefore, the differences in length of foot and leverage may have influenced the ankle strength measure more than the bounce where they are on the balls of the feet.

After ankle endurance the next highest coefficients are with arm support and with push-ups. The intercorrelation of arm support and push-ups is .504. It has been shown previously[12] that arm support is not dependent upon arm strength. Also, the coefficient between arm support and the sum of push-pull was only .118. There-

fore, the relationship between arm support and push-ups must be that factor already discussed, i.e., persistence in spite of discomfort. This factor doubtless also enters into ankle endurance (The r between arm support and ankle endurance = .357).

The coefficients with the balance items are too low to indicate any important relationship between the bounces and ability to maintain balance. The fact that bounce No. 3 is higher than the other two forms is doubtless due to the fact that the knees extend more and the center of weight goes higher and is more easily displaced.

In an attempt to get a general estimate of total strength and muscular endurance, some of the strength items were combined. These composites* and the coefficients with the three bounce forms are shown:

		Bounce 1	*Bounce* 2	*Bounce* 3
(a)	1. push and pull + 10. push-ups + .1 leg lift	.640	.494	.561
(b)	10. push-ups + .1 leg lift	.620	.611	.500
(c)	10. push-ups + 1. arm support	.624	.635	.514
(d)	1. push-ups + 1. endurance	.628	.659	.681

As a strength test, form No. 3 of the bounce would appear the least desirable because it has the lowest relationship with strength and the highest with balance. There is less difference between forms 1 and 2; coefficients in most cases favor form No. 1 and administration time is a little shorter for No. 1. It probably makes little difference whether form No. 1 or No. 2 is used, though the same form should be used uniformly at all times for all cases in a single group since the scores on form No. 2 tend to run a little higher. Form No. 2 is a little easier to teach and to administer accurately for all. Scores on form No. 3 run still higher, because the quadriceps does part of the work. If the test is being used primarily for endurance, bounce No. 3 is the better form, though some muscle soreness may be expected in some cases.

From the data presented here it appears that the bounce test is measuring to some extent general strength, persistence or willingness to work through discomfort, and endurance of leg and foot muscles. Since all of these factors seem more or less related to fitness and since the bounce test shows a fair relationship to work capacity (r = .45) the bounce test apparently would be justified in a fitness battery.

CONCLUSIONS

Inspection of the preceding data gives rise to the following observations.

* These composites were arbitrarily set up to give approximately equal weighting for each test except in (a) where push-ups were given a heavier weighting.

1. No single item in the Iowa Physical Fitness Battery has a high enough relationship to capacity to do work so that it alone could be said to be an adequate measure of the fitness of the individual. All showed significant relationship, however, so that it may be surmised that each measures a part of the total picture of fitness.

2. The battery of five items has a sufficiently high multiple correlation to indicate that it does, to a reasonable degree, measure work capacity, or will give a fair quantitative measure of dynamic physical fitness. The four-item battery comprised of pull, obstacle, sit-up, and bounce had approximately the same correlation with the criterion and would be more practicable to administer.

3. The Clarke-Brouha test of functional fitness, as indicated by these data, has little or no relationship to the individual's capacity to do work. Neither does it show relationship to the performance tests in the Iowa Physical Fitness Battery.

4. The bounce test shows significant relationship to work capacity and also to strength of various muscle groups, endurance of leg muscles, and to tests which appear to measure persistence in muscular effort.

5. Height and weight appear to have no relationship to success in any of the performance tests except the pull.

APPENDIX

The following is a description of the tests (as they vary in form and scoring from the description found in Mohr's study):

Sit-up.—Subject lies on back, knees bent, feet flat on the floor, fingers on tips of shoulder. The feet are held down securely by a partner. The subject comes to a sitting position, elbows touching knees; she returns to starting position. She is instructed to continue until she hears the signal to stop. The partner counts aloud, continuously, 2 counts for each complete sit-up, one count when elbows touch knees, one when subject returns to starting position. A third person records. There are three signals. At each signal she is instructed to record the number last counted by the partner. These signals indicate three time intervals to be used in computing a ratio score. The first occurs after 5 seconds (a period of time allowed for warm-up). The second occurs after 20 seconds, the third at the end of 50 seconds.

Three methods of scoring were used.

1. Total number of sit-ups for 50 seconds.
2. Total number of sit-ups for 45 seconds. (omitting the 5 second warm-up)
3. A ratio which was based on ***45-second total,*** 15-second total (first 20 seconds less the 5-second warm-up) with *16* as a minimum.

Chair stepping was also administered with the same time intervals for scoring and ratings were computed in three ways identical with the method used in sit-ups, except that 32 was used as the minimum in computing the ratio.

REFERENCES

1. Bass, Ruth, "An Analysis of the Components of Tests of Semicircular Canal Function and of Static and Dynamic Balance," *Research Quarterly,* 10:2 May, 1939), p. 33.

2. Clarke, Harriet, L., "A Functional Physical Fitness Test for College Women," *Journal of Health and Physical Education,* 14:7 (September, 1943), p. 358.

3. Everts, Edgar W., and Gordon J. Hathaway, "The Use of a Belt to Measure Leg Strength Improves the Administration of Physical Fitness Tests," *Research Quarterly,* 9:3 (October, 1938), p. 62.

4. Johnson, Granville, "Physical Skill Tests for Sectioning Classes into Homogeneous Units," *Research Quarterly,* 3:1 (March, 1932), p. 128.

5. Lindquist, E. F. *Statistical Analysis of Educational Research.* Boston: Houghton Mifflin Co., 1940, p. 212.

6. Meerdink, Marjorie, A Study of the Work Capacity of College Women, unpublished master's thesis, State University of Iowa, 1944.

7. Mohr, Dorothy, "The Measurement of Certain Aspects of the Physical Fitness of College Women," *Research Quarterly,* 15:4 (December, 1944), p. 340.

8. Peters, Charles C., and Elizabeth C. Wykes, "Simplified Method for Computing Regression Coefficients and Partial and Multiple Correlations," *Journal of Educational Research,* 23 (May, 1931), p. 383.

9. Scott, M. Gladys. *Analysis of Human Motion.* New York: F. S. Crofts and Co., 1942, p. 104.

10. ....., "Motor Ability Tests for College Women," *Research Quarterly,* 14:4 (December, 1943), p. 402.

11. Tuttle, W. W., and A. J. Wendler, "The Construction, Calibration, and Use of an Alternating Current Electrodynamic Brake Bicycle Ergometer," *Journal of Laboratory and Clinical Medicine,* 30:2 (February, 1945), p. 173.

12. Wilson, Marjorie, "A Study of Arm- and Shoulder-Girdle Strength of College Women in Selected Tests," *Research Quarterly,* 15:3 (October, 1944), p. 258.

Changes in Endurance and in Arm- and Shoulder-Girdle Strength of College Women in Certain Physical Education Classes

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INTRODUCTION

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THE elements of endurance and strength have been considered two of the components of physical fitness by a group of experts in the field of physical education.[1] How large a part they play in the total picture of physical fitness is not yet known, but the fact has been recognized that these elements must be present in some amount before there can be total fitness.

During the past few years, women in the field of physical education have been especially concerned with the contribution of their programs to the individual in terms of attitudes, appreciations, interests, and skills and have placed less stress on muscular development. As a result there has been but scanty scientific measurement of the various elements of physical fitness.

Women in industry, agriculture, and specific war work have need of strength and endurance more than ever before in order to stay at their jobs effectively over long periods of time. One of the questions frequently asked is whether the physical education program for women, as organized at present around participation in sports, dance, and aquatics, is effective in increasing these elements of endurance and strength.

THE PROBLEM

The purpose of this study was to find out whether there was any change in the endurance or in the arm- and shoulder-girdle strength of women enrolled in certain physical education classes at the

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1 U. S. Office of Education, Federal Security Agency. *Handbook on Physical Fitness for Students in Colleges and Universities.* (Washington, D. C.: Government Printing Office, 1943) P. 85.

University of California, Los Angeles, as measured by tests given at the beginning and end of an eight-week activity period during the spring term, 1943.

Karpovich[2] states that "endurance may be thought of in terms of *how long* a certain exercise can be continued. If the exercise involves a repetition of a certain movement, endurance may be expressed in terms of *how many times* one movement has been repeated." This is the interpretation of endurance used in this study. A modification of the Burpee test was selected as the test of endurance to be used.

Carpenter[3] found that dynamometer tests measure pure strength more exactly than performance tests such as chinning and dipping, so the push and pull on the dynamometer was the test of arm- and shoulder-girdle strength selected for this experiment.

DESCRIPTION OF THE TESTS

Endurance Test.—This test is modified from the Squat Thrust or Burpee test suggested by Glassow.[4] The exercise consists of the change from the standing position through (1) deep knee bend with the hand resting on the floor, to (2) the front leaning-rest position and back through, (3) the deep knee bend, and to (4) the standing position.

The exercise is done rhythmically to count, one movement per second. On the signal, "Ready and one," the subject squats and places her hands on the floor; on the count of "two" she thrusts body and legs back to the front leaning-rest position: on count "three" she returns to the squat position; and on count "four" she returns to the starting position. The exercise is continued until the subject can no longer execute the complete exercise in the set rhythm.

The tester counts, "Ready and *1*, 2, 3, 4; *2*, 2, 3, 4; *3*, 2, 3, 4; *4*, 2, 3, 4," giving each count one second of time and keeping the rhythm constant with a stop watch. At the beginning of the test the starting words "ready" and "and" each consume one second of time. The subjects begin moving on the word "and" at which time the counter starts the stop watch. On count "one" the subject is squatting in the deep-knee-bend position with her hands on the floor. The subjects were given three short practice periods of twelve seconds each to develop familarity with the exercise, the

2 Peter V. Karpovich, "Fatigue and Endurance," *Supplement to the Research Quarterly*, 12:2 (May, 1941).
3 Aileen Carpenter, "A Critical Study of the Factors Determining Effective Strength Tests for Women," *Research Quarterly*, 9:4 (Dec., 1938).
4 U. S. Office of Education, Federal Security Agency, op. cit., p. 87.

timing, and the method of starting before the test was actually scored. The subjects were stationed in groups of two for the test. Number one of each group took the test while number two noted the number of complete exercises the subject was able to do. The score was the number of exercises completed.

Arm- and Shoulder-Girdle Strength Test.—The subject holds her arms at shoulder level with elbows bent, upper arms parallel to the floor, and hands gripping the push and pull attachment to the grip dynamometer so that the dial faces outward. The dynamometer is held at mid-sternum level but not touching the chest. The subject first pulls on the instrument and after a moment's relaxation pushes on it. For the push, the subject pushes inward on the handles with maximum force. For the pull, the subject pulls the handles apart as far as possible.

In each case the reading was recorded from the dial of the dynamometer to the nearest five points. Three trials were given for each pair of push and pull attempts, with five minutes' rest allowed between each pair of trials. The highest push score and the highest pull score were combined to arrive at the total test score.

PROCEDURE

The students chosen were given the modified Burpee test and the push and pull dynamometer test at the beginning of the spring semester, February, 1943. They were retested after the eighth week of participation in their regular class activity.

Only those women who were approved for strenuous exercise by the university medical examiner were given the tests. Major students in physical education and women enrolled in more than one class were not tested.

The activities selected for study were limited to those in the physical education program for freshmen and sophomore women. These included archery, badminton, basketball, dance fundamentals, fencing, field hockey, folk dancing, tennis, swimming, and volleyball.

In choosing the classes to be tested the following points were considered.

1. When an activity was offered in beginning, intermediate, and advanced sections, one section of each was included in the total group.
2. If more than one class was included in a single activity group, whenever possible classes taught by the same instructor were used.
3. Individual physical education classes and classes in deck sports, although a part of the freshmen-sophomore program, were

not included because the majority of the students enrolled in these classes had some physical disability.

The purpose of the study and the reasons for each student doing her best on the tests were thoroughly explained. The scores of students who were not willing to cooperate, or who for any reason thought they could not do their best on the first test or the retest were excluded from the final results.

Scores of 458 students on the endurance test and of 451 students on the arm- and shoulder-girdle strength test were analyzed. This was considered a large enough group to show significant results.

ANALYSIS OF DATA

The emphasis in this study was placed both on the *amount of* and the *improvement in* endurance and in arm- and shoulder-girdle strength. Amount was measured in terms of the size of the first test and the retest scores. Improvement was measured as the difference between the first test and the retest scores.

In Tables I and II the endurance scores represent the number of complete exercises performed. In Table III the strength scores represent the number of pounds pushed and pulled. In Table IV the strength scores represent a combination of the push and pull in pounds.

Only the findings based upon the combined scores of all activity classes are considered to be significant. The scores for each activity were analyzed separately. Although no attempt was made to establish proof of causal relationship between the amount of improvement and the special type of activity, due to small numbers in each class, the trends are interesting.

TABLE I
TOTAL ENDURANCE SCORES OF ALL STUDENTS TESTED

	First Test	*Retest*
N.	458	458
Range	9.00-110.00	10.00-161.00
Mean	25.20	30.48
S.D.	11.58	16.56
S.E. of M.	0.54	0.77

The scores, from Table I on the first test range from 9.00 to 110.00 and on the retest from 10.00 to 161.00. These results give some indication of the endurance status of the women at the University of California, Los Angeles, at the time of the testing in the spring of 1943.

The difference between means is 5.28 in favor of the retest, giving a critical ratio of 6.00. This high critical ratio indicates that the change is greater than could reasonably be attributed to chance, being statistically significant at the 1 per cent level of confidence. This difference in means indicates that the women showed an improvement in endurance over an eight-week period.

TABLE II

ENDURANCE SCORES FOR STUDIES IN EACH ACTIVITY

Activity	*N.*	*First Test Mean*	*Retest Mean*	*Difference in Means*	*C. R.*	*Level of Confidence*
Swimming	46	27.13	38.68	11.55	3.30	1%
Fencing	16	23.12	31.25	8.13	1.84	4%
Folk Dance	54	19.36	27.06	7.70	2.97	1%
Dance Fundamentals	68	27.00	33.65	6.65	2.31	1%
Badminton	65	25.02	30.56	5.54	2.45	1%
Hockey	32	23.50	27.80	4.30	1.92	3%
Tennis	41	26.39	29.84	3.45	0.84	20%
Basketball	44	23.10	26.52	3.42	1.59	6%
Volleyball	48	25.80	29.14	3.34	2.21	1%
Archery	44	23.00	26.24	3.24	0.55	29%

In comparing the results of the total scores of each activity from Table II, it should be pointed out that the cases representing each activity group were not equated in any way but simply represent all the students who were available to be tested.

The greatest improvement in endurance was made by the students enrolled in swimming classes. The difference between the means is 11.55 in favor of the retest, with a critical ratio of 3.30 which is statistically significant at the 1 per cent level of confidence.

Students enrolled in activities which are individual or dual in nature (swimming, fencing, folk dancing, dance fundamentals, and badminton) showed more improvement than did students enrolled in team sports (hockey, basketball, and volleyball). This is probably due to the fact that in individual and dual sports each individual student gets more activity during a class period than in team sports where only part of the group is active at a time. It would be advisable to have larger numbers of cases before any predictions of value could be made.

TABLE III

TOTAL ARM- AND SHOULDER-GIRDLE STRENGTH SCORES OF ALL STUDENTS TESTED

	First Test	*Retest*
N.		
Push	451	451
Pull	451	451
Mean (lbs.)		

Push	48.75	53.25
Pull	44.60	46.85
S.D.		
Push	10.50	10.50
Pull	10.00	9.80
S.E. of Mean		
Push	0.50	0.50
Pull	0.47	0.46

The difference between the means for both the push and pull strength tests, Table III, shows an increase in arm- and shoulder-girdle strength over an eight-week period. These scores also show that the girls tested have more push strength than pull strength and that the improvement is greater in the case of the push than of the pull. The high critical ratio for both the push and the pull tests indicate that the difference is statistically significant at the 1 per cent level of confidence.

TABLE IV

ARM- AND SHOULDER-GIRDLE STRENGTH SCORES FOR STUDIES IN EACH ACTIVITY

Activity	*N.*	*First Test Mean (Lbs.)*	*Retest Mean (Lbs.)*	*Difference in Means (Lbs.)*	*C R.*	*Level of Confidence*
Volleyball	59	93.20	103.45	10.25	3.70	1%
Dance fundamentals	48	85.04	93.75	8.71	2.26	1%
Archery	41	89.65	97.85	8.20	2.15	2%
Badminton	40	85.50	93.50	8.00	2.22	1%
Tennis	58	92.30	99.40	7.10	2.32	1%
Basketball	50	91.70	98.60	6.90	2.25	1%
Hockey	36	103.35	109.70	6.35	1.41	8%
Folk Dance	38	92.85	98.40	5.55	1.40	8%
Swimming	59	105.00	106.61	1.61	0 59	27%
Fencing	22	96.10	94.90*	1.20	0.22	41%

* Represents a decrease.

The greatest improvement is shown in volleyball with a difference in means of 10.25. This improvement is 8.64 points more than that made by the swimming group which shows the least improvement. Because the swimmers already had good strength it is natural to suppose that they would not improve as much as some of the others.

It seems important to mention in connection with the improvement shown by the students in volleyball that two-thirds of class time were devoted to volleyball doubles, a form of volleyball in which each team is composed of two players rather than the eight players on the official team. The distinctive feature, as far as this study is concerned, is that each player is actively engaged in serving, passing, or playing the ball in some manner on every play in contrast with regulation games in which there is frequently quite a lapse of time between opportunities to play the ball.

The activity showing the least difference in means is fencing and the difference is in the direction of a decrease in strength. The decrease is not statistically significant as indicated by the low critical ratio of 0.22. Since this result is contrary to that which might reasonably be expected of a sport in which use of the arm- and shoulder-girdle plays a prominent part, a further investigation was made of this group. It was found that the attendance record was not as regular in this class as in the others. The reliability of the results would also tend to be reduced due to the few cases available.

Excluding volleyball, which shows the most improvement, and swimming and fencing which show the least, the other seven sports show about the same relative improvement. This is revealed in the fact that their improvement scores have a range of only 3.64 points. The increase for the entire group, excluding fencing, covers a range of 8.64 points.

Since the regular physical education program at the University of California, Los Angeles, is in the main an elective one, it is interesting to note that the women who made high arm- and shoulder-girdle strength scores on the first test chose swimming. The students who made low scores in the first test chose dance fundamentals.

RELATION OF ARM- AND SHOULDER-GIRDLE STRENGTH TO ENDURANCE

In observing the performance of the Burpee test which was used to measure endurance, it was believed that due to the nature of the exercise, which called for bearing part of the total body weight with the hands and arms, the strength of arm- and shoulder-girdle muscles might affect the number of exercises a girl could perform and so influence her endurance score.

The scores of 244 girls who had been given both the endurance test and the arm- and shoulder-girdle strength test were correlated.

The low coefficient of correlation .140 ± .04 between the two test scores indicates that execution of the Burpee test depends very little upon strength of arm- and shoulder-girdle muscles.

DATA FROM A NON-ACTIVITY GROUP

A group of students taking no physical education class activities was tested during the same time limit and under the same conditions as the students in the physical education classes. These women were junior or senior students and on the whole were about two years older than the women in the activity classes. With the exception of age and the fact that they were taking no directed activity, the girls in the two groups were fairly comparable.

TABLE V

ENDURANCE SCORES AND ARM- AND SHOULDER-GIRDLE STRENGTH SCORES FOR WOMEN IN A NON-ACTIVITY GROUP

	N.	*First Test Mean*	*Retest Mean*	*Difference between Means*
Endurance	23	21.48	21.08	—0.40
Arm- and shoulder-girdle strength	25	87.60	87.40	—0.20

Since the endurance scores and the arm- and shoulder-girdle strength scores of this group show practically no change over the eight-week period, it is possible that this may be due to the fact that students were taking no directed physical activity. The number of cases in this group is small so that no conclusive evidence can be shown.

The point can be raised that in this study no attempt was made to control the out-of-class activity of the students, which might have influenced the elements measured. However, there is no reason to believe that the students took special exercises or modified their regular out-of-class activities in order to increase their endurance or arm- and shoulder-girdle strength. The war emphasis on strength and endurance for men and women may have spurred the students on to better effort on the retest so that improvement in their scores would be shown, but no evidence was sought to indicate such influence. Whatever may have been the outside influences, there is no reason to believe that they were any greater during the eight-week experi-

mental period than during the entire college year. The first test probably would have been influenced as much as the retest and the outside activities would not invalidate the results.

The findings of this study can be considered more significant when the total group is involved than in the case of separate activities.

1. The women enrolled in certain physical education classes at the University of California, Los Angeles, during the spring term, 1943, showed improvement both in endurance and in arm- and shoulder-girdle strength at the end of an eight-week activity period.

2. Women enrolled in swimming tend to show more improvement in endurance at the end of an eight-week activity period than do women enrolled in any other activity.

3. Women enrolled in individual or dual activities tend to show more improvement in endurance over an eight-week activity period than do women enrolled in team sports.

4. The push strength of the women tested was greater and showed more improvement than their pull strength. The average for pull strength at the University of California, Los Angeles, is 53.25 pounds, with a standard deviation of 10.50 as compared with the norm of 58 pounds, with a standard deviation of 20, given in the *Handbook on Physical Fitness for Students in Colleges and Universities*. This indicates that the women in this study were slightly below the norm listed for college women but are a more homogeneous group.

5. Women enrolled in volleyball showed greater improvement in arm- and shoulder-girdle strength than those who participated in other activities.

SUGGESTIONS FOR FURTHER INVESTIGATION

1. An analysis of causes for an increase or decrease in elements of physical fitness during participation in various physical education activities.

2. An analysis of the relation of motor ability to an increase or decrease in the elements of physical fitness during participation in activities common to the physical education program.

3. An analysis of which activity or combination of activities common to physical education programs contribute most to developing all elements of physical fitness in a given period of time.

Classified, Annotated List of Available Films Riding, Horses, and Subjects Pertaining to Horses

By PHYLLIS VAN VLEET
Russell Sage College
Troy, New York

(Submitted for publication, March, 1945)

CAVALRY AND MOUNTED POLICE

Life of O'Riley (1), 16 mm., si., No. 26, "Training United States Cavalry officers and mounts at Fort Riley, Kansas." (G)*

Riders of Riley (1), 16 mm., sd., No. 5, 11a, 19, 40a, "Horsemanship by cadets." (C) (E) (G)

BREEDS AND TYPES OF HORSES

American Royal (1), 16 mm., sd., No. 11a, 19, "Many types of horses." (G)

Blue Bloods (1), 16 mm., sd., and si.; 35 mm., sd., No. 5, 11a, 31, "Raising thoroughbred race horses." (G)

History of the Horse in North America (Kodachrome): Part I. *History tory and Development* (2), 16 mm., sd., No. 5, 39, "Following the evolutionary development, as it has been reconstructed from fossils in scientific laboratories, the film traces the horse from its prehistoric ancestor, the dog-sized, three-toed eohippus, through fifty million years of change to eques, the horse of the glacial age. Modern horses are next shown in breeds which were developed in the Old World and later introduced to this hemisphere. These breeds include the Arabian, English thoroughbred, Shetland pony, Clydesdale, Percheron, and Belgian." (B); Part II. *The American Horse* (2) 16 mm., sd., No. 5, 39, "Distinct breeds which have been developed in America include the Morgan, Standardbred, Quarter Horse, and Tennessee Walking Horse. These are shown in their differentiating characteristics. Other types, more widely known for their coloring, are the Indian pony called the Apaloosa, the California Palomino and the southwestern Pinto. In addition to these may be seen the racer, hunter, polo pony, hackney, harness and draft animal, cavalry mount, saddle horse, rodeo broncho, and the parade horse." (B)

Horse and Its Relatives, The (1), 16 mm., sd., No. 11b, "Similarities and differences of the horse, burro, zebra, tapir." (G)

Horse and Man, The (1), 16 mm., si.; 35 mm., si., No. 1, 6, "Horse's

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This article was submitted by the National Section on Women's Athletics. Because of additions and withdrawals made since this bibliography appeared in the May, 1943, issue of the *Research Quarterly*, the author has prepared this revision.

* Key to film bibliography, sources, and distributors appears at end of article.

part in conquest of the New World and in modern American life; various kinds of horses." (B) (G)

Horse Power in Action (1), 16 mm., sd., No. 21, "Work and pleasure horses in action." (G)

Horses (1), 16 mm., si., No. 12, 31, 42; 16 mm., sd., No. 42, "Shows wild horses, thoroughbreds, cavalry horses; races, hunts, and events of horsemanship." (G)

"If Wishes Were Horses . . ." (2), 16 mm., si., Kodachrome, No. 41, "This is a presentation of four types of horses used in this country today, the hunter, the saddle horse, the school horse, and polo pony. Each is shown without tack for general conformation and with tack showing gaits, etc." (E)

Judging Percherons (1), 16 mm., sd., No. 4a, "Photographed principally at famed Lynwood Farm, near Carmel, Indiana, it records the visit of a party of students who review a class of Percheron mares and are enabled to compare their own observations and placing with those of an able judge." (B)

Kentucky Thoroughbreds (1), 35 mm., si., No. 42, "Facts about famous horses and their breeding in the blue grass country." (G)

King of the Sierras (1), 16 mm., sd., No. 5, 35a, "The story of wild horses on the plains and their struggle for free existence before the encroachment of their enemy, man. A simple and disarming picture of natural charm against a wide background of pine valleys and lakes. The rearing of a little colt by his father, the leader of the herd; showing him the dangers to be avoided and the little animals with whom to make friends, rescuing him when lost, and defending him from a pack of wolves." (B)

Kingdom for a Horse (1), 16 mm., sd., No. 5, 44, "Old Dobbin tells the story of his high and low-born relatives—the blue ribbon high stepper, polo ponies, race horses, hunters, trotters, jumpers, bucking bronchos, and even the almost extinct fire horse." (B)

Life of Seabiscuit (2), 16 mm., sd., No. 11a, 19, 23, 44, "Development of the famous race horse." (G)

"On the Nose" (1), 16 mm., sd., No. 2a, "A series of hunting scenes in the South in which a fox hunt is shown from start to finish. Chesapeake Bay Retrievers are shown in action in duck hunting; pointers and setters are shown in quail hunting." (A)

Royal Steeds (1), 16 mm., sd., No. 11a, 19, "Lively picturization of the world's most famous breeds. Bill Corum." (G)

Thoroughbred (2), 16 mm., si., 35 mm., sd., No. 6a, "Types of horses in Britain: tasks for which they are used." (G)

Three and Five-gaited Saddle Horse (1), 16 mm., si., No. 39a, "Designed to familiarize the student with the recognized saddle-horse type and gaits. Close-ups and slow-motion photography emphasize correct details." (B)

Today's Horse Farm: Sun-up to Sun-down (1), 16 mm., sd., Kodachrome, No. 17a, "The film opens with Bonnie, a champion white draft horse, and her stable mate, Black Mammy, poking their heads out of their stable windows eager for the day to start. It follows these two and their colts through the day in their contact with men and with other horses . . ." (B)

TRAINING

Bit and Bridle (1), 16 mm., sd., No. 2a, "In this picture we see children of the very wealthy reared on horseback in Aiken, S. C., where unpaved highways and an abundance of horses encourage the sport. Groups of children, some of them as young as three years old, are shown riding and learning to steeplechase. There is a sequence in the care of horses. We see a drag hunt and harness racing. Slow motion photography brings out the muscular movement of the harness horses as

they go around the track." (A)

Blue Grass Kings (1), 16 mm., sd., No. 19, "Racing horses in training and action." (G)

Bugles from the Blue Grass (1), 16 mm., sd., No. 19, 11a, "Portrays the work and care necessary in the raising of race horses." (G)

Harnessed Rhythm (1), 16 mm., sd., No. 2a, "The care and training of race horses with discussion of the equipment for the horse and sulky." (A)

Horse (1), 16 mm., sd.; 35 mm., sd., No. 16b, 40a, "After showing the role of the horse in modern life, the film follows the development and training of a colt from one week to three years of age in the blue grass country of Kentucky. A horse breeder, his granddaughter, and a trainer minister to the needs of the colt, Prince, who is training for the walking, trotting, and cantering gaits before appearing in a horse show shortly after his third birthday." (B)

Horse Raising (1), 16 mm., sd., Kodachrome, No. 17a, "A prospective buyer arrives to look over the horses on a large horse farm. The points of a fine horse are brought out: good head, chest, back, hindquarters, and legs, and the horses are put through their paces in the ring; Percherons, Standard Bred Trotters, Belgian, Tennessee Walking Horses, and Arabians are exhibited. Breeding of fine stock as well as mules is discussed. The importance of proper treatment and training is stressed. The veterinarian arrives on his regular visit. The film shows that a horse should be well-housed, fed, shod, harnessed, and driven. The importance of correct bits, bridles, and harness is brought out. A horse is properly saddled. An eight-horse wagon hitch is prepared for the country fair. The grooming, braiding, decorating, and harnessing of these magnificent white horses is done with meticulous care." (B)

Timber Toppers (1), 16 mm., sd., No. 2a, "Training a horse to jump. The picture opens with close-ups of Bartender, a champion jumper, and his trophies." (A) (E)

Trained Hoofs (1), 16 mm., sd., No. 2a, "The care and training of a colt from its birth to its first race. This picture includes closeups of Sir Galahad III, Crusader, and Man O' War. A group of horsemen examine a newborn colt in the stables. A sick colt is cared for. A young horse is introduced to bridle and bit. Later he is slowly broken to the saddle. The committee's comment is: 'Recommended as good informative material in all grade levels on how race horses are trained.'" (A) (G)

Training a Roping Horse (1), 16 mm., si., sd., No. 5, "Produced by the Educational Division of See-anay films. While we gaze at rodeo scenes the commentator explains that such stunts as are here viewed are actually needed in the everyday life of a cowhand. . . . Then we see a cowboy who knows his job thoroughly. He instructs youngsters in throwing a lariat. We see various mounts and then shots of cowboys training their horses." (B)

Trotting Thoroughbreds (1), 16 mm., sd., No. 2a, "Another picture on the training of race horses. The Committee's comment is: 'While the subject of this picture is not related to the curriculum in any direct way, it is included in this catalogue on the theory that social studies may review the history of the county fair, a traditional and important institution in American life. The trotting races were the climax of the country fairs.'" (A)

POLO

Polo (1), 16 mm., sd., No. 2a, "Recommended by the Committee for all grades through college." (A)

Swinging Mallets (1), 16 mm., sd., No. 2a, "The Committee's comment

is: 'Probably the best picture on polo, but its use, of course, is limmited.'" (A)

WESTERN

Cattle (1), 16 mm., si., No. 16b, "Cowboys herd cattle, live out on the range, shoe their horses, round up the cattle, and 'dip' them to kill parasitic ticks. There are scenes of cattle feeding and typical scenes at a rodeo showing the skill of the cowboy." (B)

Cattleman, The (1), 16 mm., sd.; 35 mm., sd., No. 16b, "Impressions of life on a cattle ranch. Cowboys repair a fence and drive cattle to the range in the foothills. The ranch blacksmith shoes a horse, a herd of half-wild horses is driven into a corral. One horse is singled out, roped, thrown, saddled, and ridden into submission. At the end of the summer the round-up is begun. Calves are branded with hot irons. Their work finished, the cowboys start for home singing a cowboy song." (B) (H)

Hoot Gibson Rodeo (1), 16 mm., si., No. 1, "Fast moving film of cowboys and cowgirls, broncho busting, steer riding, etc." (C)

Let 'er Buck (1), 16 mm., sd., No. 5, 19, "A western rodeo; broncho busting, calf roping, bulldogging steers, etc." (G)

On the Trail (1), 16 mm., si., sd.; 35 mm., sd., No. 44, "Life on a dude ranch; mountain lion hunt; pack trip, a rodeo." (G)

Ranch Holiday (1), 16 mm., si.; 35 mm., si., No. 33, "Life on Dude Ranches." (G)

Ride 'em Cowboy (1), 16 mm., si.; 35 mm., si., No. 11a, "Cheyenne Frontier Days Celebration; fancy stunt riding, calf roping, etc." (G)

Riding High in the Canadian Rockies (1), 16 mm., sd., No. 7a, "A saddle trip through the Canadian Rockies with the trail riders, in natural color." (B)

Rodeo Goes to Town (1), 16 mm., sd., No. 2a, "Visit to Texas ranches; contestants practice for rodeo." (G)

Round-Up Time in New Mexico (1), 16 mm., sd., No. 32a, "This color film shows a typical round-up in New Mexico. Rounding up calves, branding, and how the cowboys live during round-up time are all portrayed in the film." (B)

She's Wild (1), 16 mm., si., No. 1, "Cowboys on cattle ranges; broncho busting; roping and tying and other exhibitions." (C) (G)

Sky High Stampede (1), 16 mm., si., No. 1, "Rodeo time. Parade, Indians, floats, with cowboys and cowgirls all in action." (C) (G)

Trail Riders of the Wilderness (2), 16 mm., si.; 35 mm., si., No. 38, "The record of an American Forestry Association tour of primitive areas of the Flathead and Lewis and Clark National Forests. Members of the party motor by bus from Missoula, Mont., to a base camp where they are supplied with horses, a pack train, camping equipment, and guides. Shows the many points of interest covered by the party on a 10-day riding trip over trails leading to the South Fork and Sun River areas of western Montana." (F)

Ups and Downs of a Broncho Buster (1), 16 mm., si.; 35 mm., si., No. 36, "Rodeo thrills." (G)

Western Whoopee (1), 16 mm., sd., No. 5, "Wild West Sports." (G)

When Winter Comes to the Range (¼), 16 mm., si., No. 5, 7, "Vivid picturization of hardships suffered by man and beast when a blizzard strikes the range." (G)

Where the West is Still West (1), 16 mm., si., No. 5, 7, "Round-up riding and pastimes on the ranges." (C) (G)

Wild West (¼), 16 mm., si., No. 20, "Broncho busting, roping and riding thrills." (G)

World Famous Rodeo, The (¼), 16 mm., si., No. 5, "Wild-west stunts at Pendleton, Oregon." (G)

INSTRUCTIONAL

Ground Technique (2), 16 mm., si., No. 39a, "Proper methods of saddling and bridling a horse, mounting, position on horse, turning, backing, dismounting, and leading are demonstrated. Close-ups and slow-motion photography emphasize correct details." (B)

Riding Activities of the Perry-Mansfield Horsemanship Training Course (2), 16 mm., si., No. 34a, "Excellent photography in most scenic surroundings. Reel I covers saddling, bridling, and riding three-gaited horses in western and eastern styles. There is a sequence on schooling jumpers in a pen. Some jumping scenes and shots from a horse show complete the reel. Reel II shows a drill, gymkhana events, and a long sequence of an advanced mountain trail pack trip which includes swimming rivers on horseback. Bareback drill and stunts complete the film. Both reels are very good interest films, well planned to lure any girl 'to go West.'" (E)

Riding Technique (1), 16 mm., si., No. 39a, "This reel presents 'The English style of riding the three common gaits.' Close-ups and slow-motion photography emphasize correct details." (B)

Saddle Sense (2), 16 mm., si., Kodachrome, No. 41, "An instructional film based on approved fundamental techniques of horsemanship, produced especially for use in schools and colleges."

MISCELLANEOUS

Horses and Bots (2), 16 mm., si.; 35 mm., si., No. 38, "Three types of bot-flies, how they attack horses and mules; methods of treatment; eradication campaigns." (F)

Sport Parade 16 mm., si., sd., No. 1; 16 mm., si., No. 4, One part, one of the subjects called 'Horses,' of a larger series." (B)

Key to Film Bibliography

Film title; number of reels in parentheses; size of film, i.e. 16 mm., or 35 mm.; silent (si.) or sound (sd.); number referring to distributor; annotation; letter refers to sources for film bibliography.

Key to Sources for Film Bibliography

A. *Catalogue of Films for Classroom Use,* Teaching Film Custodian, Inc., 25 West 43rd Street, New York City.

B. *Education Film Catalogue,* Dorothy Cook and Eva Cotter Rahbek-Smith, H. W. Wilson Company, New York, 1936, 1937, 1938, 1939, 1940-41, 1944, Supplement, April, 1944.

C. "Motion Pictures in Health and Physical Education," Hughes and Stimson, *Research Quarterly,* A.A.H.P.E.R., Vol. X, March, 1938.

D. *Motion Pictures for Instruction,* A. P. Hollis, The Century Co., New York, 1926.

E. *Motion Pictures in Sports,* Motion Picture Committee of the N.S.W.A. A.A.H.P.E.R., Washington, D. C., including supplement, March, 1940.

F. *Motion Pictures of the United States Department of Agriculture,* Miscellaneous Publication No. 451, Washington, D. C., November, 1941.

G. *1000 and One,* The Educational Screen, Chicago, Ill. 1935-36, 1936-37, 1937-38, 1939-40, 1940-41, 1941-42, 1942-43, 1943-44.

H. *Selected Educational Motion Pictures,* American Council on Education, 744 Jackson Place, Washington, D. C., 1942.

Key to Distributors

1. Akin and Bagshaw, Inc., 2023 E. Colfax Ave., Denver, Colo.
2a. American Museum of Natural History, Film Division, Central Park West at 79th St., New York 24, N. Y.
4. Anderson Supply Company, Inc., 111 Cherry Street, Seattle, Wash.
4a. Atlas Educational Film Co., Oak Park, Ill.
5. Bell and Howell Co., 1801 Larchmont Avenue, Chicago 13, Ill.
6. Brigham Young University, Bureau of Visual Instruction, Provo, Utah.
6a. British Library Information, Rockefeller Plaza, New York, N. Y.
7. Burton Holmes Films, Inc., 7510 North Ashland Avenue, Chicago, Ill.
7a. Canadian Pacific Railway, Cincinnati, Ohio.
11a. Cinema, 234 Clarendon Street, Boston 16, Mass.
11b. Coronet Instructional Films, Glenview, Ill.
12. Cosmopolitan Film Libraries, Inc., 3428 Gratiot Ave., Detroit 7, Mich.
*16b. Encyclopaedia Britannica Films, Inc., 1841 Broadway, New York, N. Y.
*17a. Frith Films Company, Box 565, Hollywood, Calif.
19. Gutlohn, Walter O., Inc., 35 West 45th Street, New York, N. Y.
*20. Hollywood Film Enterprises, Inc., 6060 Sunset Boulevard, Hollywood 28, Calif.
21. Horse and Mule Association of America, Inc., 407 S. Dearborn St., Chicago 5, Ill.
23. Ideal Pictures Corporation, 30 East Eighth Street, Chicago, Ill.
26. Eastman Kodak Stores, Inc., Kodascope Libraries Division, 356 Madison Ave., New York, N. Y.
31. National Cinema Service, 71 Dey Street, New York, N. Y.
32a. New Mexico Tourist Bureau, Santa Fe, New Mexico.
33. Northern Pacific Railway, 560 Fifth Ave., New York 19, N. Y.
34a. Perry-Mansfield, Fenimore Road at Cornell, Scarsdale, New York.
35a. Post Pictures Corporation, 723 Seventh Ave., New York, N. Y.
38. United States Department of Agriculture, Division of Motion Pictures, Washington, D. C.
39. University of California, Extension Division, Berkeley 4, Calif.
39a. University of Minnesota, Extension Division, Minneapolis, Minn.
40a. University of New Hampshire, Extension Division, Durham, N. H.
41. Van Vleet, Phyllis, Russell Sage College, Troy, New York.
42. Wholesome Film Service, Inc., 48 Melrose St., Boston, Mass.
44. Y.M.C.A., National Council of Motion Picture Bureau, 347 Madison Ave., New York, N. Y.

There are many other Visual Education Departments in colleges and universities that may be the distributors for the films listed.

*** These distributors have films for outright sale only.**

Research Quarterly Abstracts

Prepared by the

NATIONAL COUNCIL OF THE RESEARCH SECTION

ANATOMY AND ANTHROPOLOGY

Damon, Albert, and Francis E. Randall, "Physical Anthropology in the Army Air Forces," *Am. J. Phys. Anthrop.*, N. S., 2:3 (Sept., 1944).

The background, history, and operation of physical anthropology in the Army Air Forces have been briefly summarized. Initiated as a consequence of pressing military problems involving human dimensions, the basic procedure was an anthropometric survey of the Army Air Force flyers, several thousands of whom have now been measured. These measurements have been applied to the selection of personnel and to the design and sizing of military aircraft and associated equipment, including gun-turrets, oxygen masks, flying clothes, and parachutes, with the aim of increasing the comfort, efficiency, visibility, and safety of flying personnel. The Army Air Force anthropological program has served as a model in the organization of a similar project by the Armored Command, Army Ground Forces.—*Wistar Institute.*

Michelson, Nicholas N., "Studies in the Physical Development of Negroes. III: Cephalic Index," *Am. J. Phys. Anthrop.*, N. S., 1:4 (December, 1943).

The decrease of the cephalic index from birth to adult age is shown for the American negro. The excess of the female over the male cephalic index is about the same for whites and negroes. For the general population of the American negro the head form was found to be stable. Measurements made by the author in 1935 tallied with those obtained by M. J. Herskovits in 1923-1926. A possible tendency toward a change in the head form could be detected in 1941 in a group of negro children which had been on a scientific dietary regime since early infancy. A shortening of the average length and an increase of the average breadth of the head, resulting in greater values for the cephalic index, were predominating features in that selected series. However, in view of the small size of the latter, an element of chance may have influenced the results. A control study on a large scale is indicated.—*Wistar Institute.*

House, Ralph W., "The Stage of Maturation Found in 318 First-Grade Pupils," *J. Educ. Research.* 37:3 (Nov, 1943).

This article reports an experiment to determine the status of body maturation of 318 pupils selected from the entire enrollment of first grades of elementary training schools of three state teachers colleges, one state university, one church elementary school, and six public elementary schools.

Todd's Differential Skeletal Maturation Method was used in assessing the radiographs of the posterior anterior X-Rays of the left hand and wrist.

Twenty-one per cent of the group revealed a body maturation of ten months or more under the chronological age. Sixty-six per cent had approximately the same body maturation as chronological age, and thirteen per cent were ten months or more above the chronological age.—*Helen Coleman.*

EDUCATION

Feingold, Gustav A., "Newspaper Tastes of High School Pupils," *School and Society*, 59, 1531: 316-319.

Students from an average high school were selected. Of the 722 students 330 were boys and 392 were girls in grades 9-12. The questionnaire method was used.

Twenty-three of the 722 or 3 per cent did not read newspapers. Seventy-eight per cent of the group read papers at home while 9 per cent read in the school library or school library and home. Sixty-nine per cent read more than one daily paper.

In regard to time spent reading 17 per cent spent less than 15 minutes, 51.1 per cent spent between 15 and 30 minutes, and 5.4 per cent spent an hour or more.

Boys were found to read for longer periods of time than girls Girls were found to read editorials more than boys. They also read the advertisements more than the boys. The boys read more material dealing with science, aviation, and industry.—*Carolyn Bookwalter.*

Reynolds, Floyd Johnson, "Factors of Leadership Among Seniors of Central High School of Tulsa, Oklahoma," *J. Educ. Research,* 37:5 (Jan. 1944).

Data for the study were gathered from cumulative records of eight hundred and eighty-eight graduating seniors who had completed six semesters of study in the Tulsa High School. Four hundred and thirty-seven were designated as leaders and four hundred fifty-one as non-leaders. Leadership was based on the number of points earned as officers of clubs, committee services, captaincy of athletic teams, etc., in the all-school program. Point values of activitiies were established by the faculty.

Coefficients of correlation were calculated between total leadership and each of the factors of scholastic achievement, personality traits, and heights of the individuals.

Findings of the Tulsa study agreed substantially with the factors found in other similar investigations. It was found that leaders tend to excel in scholarship, to have more definite personality traits, and that height was not a significant factor.—*Helen Coleman.*

Thom, Douglas A., and Nancy Newell, "Hazards of the High I. Q," *Mental Hygiene.* (Feb. 1945).

A follow-up study was made of 43 children of I. Q.'s above 130 who had been seen in the Massachusetts Child Guidance clinics between 1927-1934. The interval between the first contact and the follow-up averaged 11 years.

Consistency of later examinations indicated the early psychological tests were reliable and predictive of continuing ability. Success or failure of the individual depended upon factors other than his numerical intelligence quotient.

From the clinical point of view a need was revealed for closer relationship of schools with social and clinical services in order to relieve emotional pressures. Public schools have, on the whole, offered little in the way of specialized opportunities for superior children because this group gets along creditably in the program geared to the average child. For the superior group there is no emotional appeal to pity or protection such as has been used to obtain appropriations for the education of the handicapped or retarded group.—*Carolyn Bookwalter.*

HEALTH AND NUTRITION

Meyer, Frieda Louis, and Milicent Louise Hathaway, "Further Studies on the Vitamin C Metabolism of Preschool Children," *J. Nutrition,* 28:2 (August, 1944).

Vitamin C studies were continued on two or more groups of four preschool children over periods of 5 months. Five variations of the diet were used: basal diet alone, basal diet plus 100 mg. ascorbic acid, basal diet plus 3.38 gm potassium citrate with and without the ascorbic acid supplement,

and basal diet plus orange juice. Daily intakes of 23-25 mg. ascorbic acid were not sufficient to maintain tissue saturation in these eight children. When potassium citrate was added to the diet, the utilization of ascorbic was increased in five children at both levels of ascorbic acid intake, and in two others at the higher level of intake. Whenever individual differences in mean response were found, they were in the same direction, but all the increases were not mathematically significant. On the substitution of orange juice for crystalline ascorbic and potassium citrate the utilization of ascorbic acid was significantly increased in the four children studied.—*Wistar Institute.*

Winters, Jet Corine, and Ruth Elizabeth Leslie, "A Study of the Diet and Nutritional Status of Women In a Low-income Population Group," *J. Nutrition,* 26:5 (Nov., 1943).

Food samples, duplicating in kind and quantity the food actually consumed during a day were collected for periods of 1, 2, or 3 weeks at three different seasons from twenty-four young married women living in the Anglo-American, Latin-American, and negro housing projects in Austin, Texas. The incomes of the families represented were comparable and averaged $13.50 weekly. The diets collected were assayed for protein, phosphorus, riboflavin, niacin, pantothenic acid, and thiamine. Caloric intakes were calculated from an average value obtained from bomb calorimeter determinations on representative samples. Seasonal or racial variation in intake was slight. Severe deficiencies in calories, protein, calcium, and vitamins were indicated. Caloric intakes averaged 1,145 calories; protein, calcium, and phosphorus intakes were approximately one-half the recommended allowances; thiamine, niacine, and riboflavin intakes were slightly more than one-third of the recommended allowances. Physical examinations of fifteen women for anatomical evidence of deficiency revealed signs of riboflavin deficiency in seven cases, niacin deficiency in nine, definite thiamine deficiency in none, vitamin A deficiency in six, ascorbic acid deficiency in nine. Because of the lack of grave manifestations of malnutrition as a result of the extremely low intakes, the suggestion is made that the question of whether or not the recommended daily allowances have been placed too high might be worthy of further investigation.—*Wistar Institute.*

PHYSIOLOGY

Fries, E. Corinne, "Some Physiologic Effects of Passive and Active Exercise," I *Archives of Physical Therapy,* 25:9 (Sept., 1944).

Two women who had had professional training in physical education and were aged 22 and 31 were tested on a motor-driven bicycle ergometer. The ergometer made it possible to administer passive and active exercise simultaneously to different parts of the body of the same subject. Eight exercises ranging from mild passive activity to heavy work were given.

The circulatory adjustment of the individual was found to offer an objective method of defining severity of work done. The exercises could be mild which involved no circulatory stress or they could be heavy muscular work causing vascular adjustments paralleling those of anaerobic activity. Rapid leg motion as incited passively by the machine exerts little or no effect on the general circulatory mechanism.—*Carolyn Bookwalter.*

Fries, E. Corinne, "Some Physiologic Effects of Passive and Active Exercise: Training Effects on the Strength of Specific Muscle Groups, II *Archives of Physical Therapy,* 25:9 (Sept., 1944).

Eleven women between the ages of 20 and 41 years of age and who had had professional training in physical education or were members of the WAC performed a bout of combined active and passive exercise on a motor-driven bicycle ergometer. They performed for ten minutes daily for twenty-one consecutive days. The muscle groups were tested by the Martin strength test before and after the training period.

A demonstrable increase in muscle strength was found. The flexors and extensors of the elbow joint were little employed to perform the strong arm movements but the work was found to be done by the shoulder girdle. The knee flexors did not exhibit a significant change in strength with training.

It is suggested that there might have been a physiologic relationship between muscle soreness during training and the subsequent increase in muscle strength.—*Carolyn Bookwalter.*

PHYSICAL EDUCATION

Rarick, Lawrence, "A Survey of Athletic Participation and Scholastic Achievement," *J. of Educ. Research,* 37:3 (Nov., 1943).

A survey was made of the literature dealing with the relationship of scholastic achievement to interscholastic, intercollegiate, and intramural athletic participation. The studies reviewed included seven surveys of interscholastic athletics, the Carnegie Foundation Report on College Athletics which included ten studies, and four studies of intramural participation.

The general trend seemed to indicate no deleterious influence on scholastic achievements from participation in athletics. Those participating extensively in intramural programs compared most favorably in scholastic achievement.

The author concludes, "Since it is difficult to demonstrate that time spent in athletic participation is detrimental to scholarship, and since it is becoming increasingly evident that good health and physical fitness is a worthy goal, more time could be spent on conditioning activities in both high schools and colleges."—*Helen Coleman.*

PSYCHOLOGY

Rethlingshafer, Dorothy, "Measurement of a Motor Set," *J. Exp. Psy.,* 32, 1:75-81 (Jan., 1943).

The author states that "any motor set, apparently set up by a forced rhythm, is quite temporary, although it lasts long enough to affect a highly reliable performance." The natural rhythm of the motor set was determined by three trials of tapping on the Stoeling tapping board. A metronome was used to set the enforced rhythm rate. The natural tapping rate can be reproduced at varied sessions with a high reliability. Three specific conditions were investigated, namely the effect when subjects tapped at half their natural rate, effect when forced to go faster than natural rate, and a constant rhythm for the entire group. The effect of the enforced rhythm shows marked individual differences.—*Helen Coleman.*

Wenger, M. A., "An Attempt to Appraise Individual Differences in Level of Muscular Tension," *J. of Exp. Psy.,* 32, 3:213-225 (March, 1943).

The following two problems as quoted by the author were considered:

"(a) can the postulated trait of characteristic level of muscular tension be rated reliably, and (b) if so, will the ratings serve to define a muscular factor when included in a body of appropriate data submitted to factor analysis?" Characteristic levels of muscular tension were rated by a scale developed after the Champney form. These ratings and 16 other physiological variables were intercorrelated and submitted to factor analysis by the centroid method. One meaningful factor found was defined as the factor of muscular tension. Wenger states, "Both sets of correlations are believed to furnish additional evidence that generalized muscular tension is a correlate of certain aspects of personality." He concludes "that factorial estimation affords the most adequate technique for the measurement of general muscular tension and further analysis of more rigorously designed tests should yield a muscular factor of considerable significance in the appraisal of human behavior."—*Helen Coleman.*

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2. Papers are not judged by arbitrary standards of length but on their content of new research results in the field of physical education, health education, and recreation, presented with the greatest brevity compatible with scientific accuracy and clarity.

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Footnotes should be separated from the text by lines running across the page. They should be inserted at the point in the page where the reference occurs.

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1 Katherine B. Crisp, *Health for You*, p. 520. (books)

2 Stern, Frances. *Applied Dietetics*. Baltimore: Williams and Wilkins Company, 1943. (books)

3 Corbin, H. D., "Current Problems in Recreation," *Journal of Health and Physical Education*, 15:6 (June, 1944), pp. 315-16, 353-54. (magazines)

4 Kraines, S. H., and E. S. Thetford. *Managing your Mind*. New York: The Macmillan Company, 1944.

Although this form is preferred in the *Quarterly*, authors may submit articles with references prepared differently provided the essential information is given and the style used is that of well known journals.

There are many sources of information relative to the preparation of manuscripts for publication. A good source is *A Manual of Style* (10th Edition), Chicago, University of Chicago Press, 1937.

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